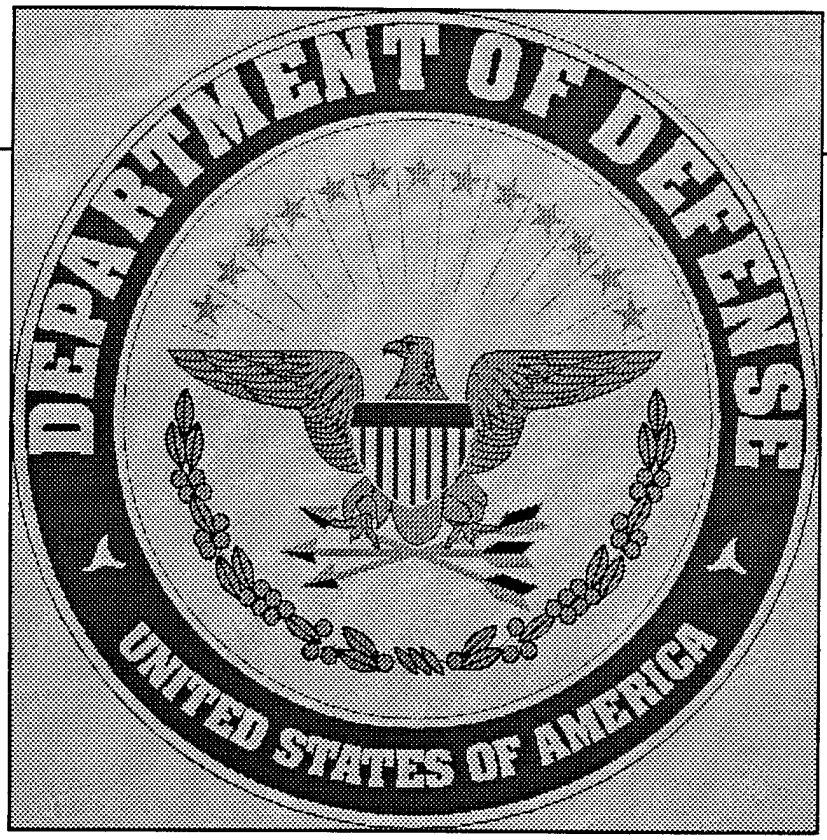

CAIS STANDARD MANUAL

SYSTEM NO. 2
BUILDING
SUPERSTRUCTURE

CAS PROJECT
CAIS MANUAL

Issued April 28, 1995

8 Mar 96

MEMORANDUM FOR DTIC-OCP
ATTN: Ms. Lue Lynch
8725 John J. Kingman Road, Suite 0944
Fort Belvoir, VA 22060-6218

FROM: AL/EQ (STINFO)
139 Barnes Drive. Suite 2
Tyndall AFB FL 32403-5323

SUBJECT: Transmision of Technical Documents

1. As per telephone conversation with Andrew Poulis, EQ/TIC, the attached CAIS CTDS manuals are forwarded for accession, cataloging, and microconversions. Please forward the accession numbers to:

Andrew Poulis
AL/EQ/TIC
139 Barnes Drive. Suite 2
Tyndall AFB, FL 32403-5323

2. The Distribution statement should read as follows: Approved for Public Release: Distribution Unlimited.

3. If you have questions about these documents, please contact Andrew Poulis at DSN 523-6285.

LARRY L. TESTERMAN
Scientific and Technical
Information Program Manager

Atchs: Manuals

02 BUILDING SUPERSTRUCTURE

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02 BUILDING SUPERSTRUCTURE

ABSTRACT

GENERAL ORGANIZATION

At this installation the list of facilities to be surveyed will be addressed on the basis of 32 unique systems that form the CAIS Engineering Deficiency Standards and Inspection Methods document. Each system deals with a specific technical aspect of the facility to be surveyed. Within each system a further breakdown is made to subsystems, each having a specific list of components. Specific observations of the listed defects are provided so as to allow the entry of observed quantification data. A DOD CAIS manual is provided for each of the 32 systems with an internal organization as outlined below:

INSPECTOR'S GUIDE

I. General
   - A. Level I Inspection Method Description
   - B. Level II Inspection Method Description
   - C. Level III Inspection Method Description

II. General Inspection
   - A. Process. This section describes the process of the inspection activity.
   - B. Location. This section describes the procedure for locating the inspection units in the facility or infrastructure on this installation.

III. Inspector Qualifications
   This section notes the minimum qualifications for the person or persons performing the survey.

IV. Inspection Unit
   This section describes how the IU (Inspection Unit) is determined for the particular component being surveyed.

V. Unit Costs
   This section notes the nature of repair costs for this system.

VI. Standard Safety Requirements
   This section lists safety procedures and equipment required to implement a safe environment for the conduct of this survey.

VII. Standard Tools
   This section lists a set of standard tools required for the general conduct of this survey.

VIII. Special Tools and Equipment Requirements
   This section refers to special tools or equipment requirements endemic to the nature of the system being surveyed.

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IX. Level II Inspection Method Keys

This section explains the use of keys as they relate to Level II Guide Sheets.

X. Level III Inspection Method Keys

This section explains the use of keys as they relate to Level III Guide Sheets.

XI. Replacement Cost

This section describes the nature and location of replacement cost data.

XII. Appendices

Appendix A. Provides a listing and definition of all abbreviations used both in the Standards and in the data base.

Appendix B. Provides a glossary of terms with their definitions as used in the Standard.

Appendix C. This section contains a listing of the average life cycle durations for each assembly* in the Standard.

* Assembly is a term describing the level at which replacement rather than repair occurs. This can be at the subsystem or component designation, depending on the system being surveyed.

SYSTEM TREE

The System Tree is a graphical representation of the Work Breakdown Structure, showing system, subsystem and component relationships for the Building Superstructure System.

INSPECTION METHODS

Description

Describes the nature of what is to be condition surveyed.

Special Tool and Equipment Requirements

Lists any special tools required for this specific subsystem.

Special Safety Requirements

This section outlines any special safety measures or equipment required for this specific subsystem so as to maintain a safe environment and process in the conduct of the condition survey.

Component List

All components to be surveyed under this subsystem are listed here.

Related Subsystems

All other subsystems that have a survey relationship to this subsystem are listed here to help coordinate a complete and thorough condition assessment survey.

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Standard Inspection Procedure

This statement indicates the various levels of survey effort required for this subsystem.

Components

The previously listed components of this subsystem are described with a survey procedure recommended on a component by component basis. For each component there is a listing of defects with each defect broken down into observations describing the nature and severity of the defective condition observed. The surveyor enters a quantification value for each defect/observation encountered in the field CAIS device (DCD) to record the result of his survey.

References

This page lists the reference sources from which the foregoing subsystem data was developed.

Guide Sheet Control Number

This section lists the key numbers that tie the written Level II and Level III guide sheets to specific components in this subsystem.

Level II and Level III Inspection Method Guide Sheets

This section contains the detailed descriptions of the Level II and III survey and inspection procedures for this subsystem.

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INSPECTOR'S GUIDE

I. GENERAL

A. Level I Inspection Method

The Level I Inspection Method of building superstructure systems consists of a thorough inspection of each subsystem and component as described in the Work Breakdown Structure. Only readily accessible components need to be addressed during a Level I inspection. The survey activity is designed to be performed by a single surveyor.

B. Level II Inspection Method

Level II inspections are triggered by defect/observations noted at the Level I inspection or in some cases, are required to conduct a meaningful survey of the component being inspected. There are very few Level II inspections, since most defects are readily apparent from a Level I. Wood structures may require additional cleaning and probing to determine the quantity and level of severity for the defects identified in a Level I. Metal cracks and welds may require dye penetration testing to determine the extent and size of cracks identified in the Level I inspection. Level II inspections are referenced by defect/observations through a "Level II key", which denotes a specific Guide Sheet that describes the Level II inspection activity.

C. Level III Inspection Method

The Level III inspection is triggered by defect/observations occurring in the Level I and II inspections. The Level III inspection can also occur as a result of time based scheduling, antidotal experience, or component age compared to its life cycle. The Level III inspection is referenced through a Level III key which in turn, denotes a specific Guide Sheet describing the Level III inspection process and requirements. Level III inspections produce a detailed, written engineering assessment of the deficiency along with an estimated cost of correction, and are performed at the option of the Facility Manager.

II. GENERAL INSPECTION

A. Process

Surveys are normally conducted at the component level. Figure 02-A provides the breakdown from system through component for the Building Superstructure System. The surveyor will work through the Work Breakdown Structure (WBS) to conduct the inspection. At the component level the surveyor will be provided a list of defects, each of which is described further in detail as observations. These observations are described to various levels of severity as they relate to the effect of the life of the system. The quantification of each deficiency is identified by the surveyor using the associated unit of measure. Once an observation is populated with a deficient quantity, the inspector will be requested to provide information on the component type

02 BUILDING SUPERSTRUCTURE

and location. The installation date or age of the component may be preloaded into the WBS for each asset from the Real Property Inventory List or site specific information. If necessary, age data can be overridden by the surveyor, Site CAIS personnel, or the Facility Manager.

B. Location

Level I and II inspections will be located by the surveyor through a discrete entry in the Field CAIS. Building floor plans or sketches are required to ensure a complete inspection of all areas and to assist in the location of IU's. The inspection team members must use the recommended room numbering schemes for the installation. The installation may have rooms physically identified by a numbering system or identified on floor plans. If both exist and are different, the Facility Manager will develop guidance on which numbering system takes precedence. Where numbering systems do not exist or are not complete in identifying each space, specific guidance for the inspector to annotate areas in a consistent manner should be developed by the Facility Manager and implemented in the installations CAS process. In all cases, plans and maps shall be orientated with the top of each sheet being the north direction, so as to allow directional location and description. In the case where no other means of location exist the inspector shall enter a brief (65 character) description of location. Locations must be accurate to insure future repeatability and consistent results.

III. INSPECTOR QUALIFICATIONS

The minimum inspector qualification for the Building Superstructure System requires a five year journeyman. All of the condition survey requirements for this system can be accomplished at the Level I inspection by a single inspector, however, safety and other considerations may require that inspectors work in teams. Inspectors will be specifically trained in the CAS system and its usage and will be CAS certified in the "Civil" discipline.

IV. INSPECTION UNIT (IU)

The Inspection Unit (IU) is normally defined at the component level for this system. The varied configurations of the components that exist in the Building Superstructure System require that they be evaluated differently when defining the IU. Therefore, the measurement technique requires some consideration. If the inspector finds multiple defects that occur on the same IU, the inspector will quantify the observation that is considered most severe and identify the remaining quantity under the less severe observation for the discrete component. The following are some guidelines for establishing IU's for components in the Building Superstructure System:

- Structural frames are measured in **square feet** of area that the framing covers. In many cases the square footage will equal the length of the member.

- Floor/roof framing and decks, balconies, and canopies are measured in **square feet.** If large areas exist within a location, the IU is defined by the

02 BUILDING SUPERSTRUCTURE

area of coverage within the location. In particular, the IU for roof framing and decks should generally equal the square footage of the room from which the defect is viewed.

- Stairs are measured in **square feet** (measured horizontally, not vertically), and are divided into separate IU's if they extend between floors or are exterior to the building.

- Ladders and ladder cages are measured in **linear feet** and the IU is defined as a continuous length.

- Ramps are measured in terms of the **square feet** of the traveled surface and can be divided as separate IU's between expansion joints.

- Handrails and guardrails are measured in **linear feet.** When the adjacent balcony, stairs or ramp are divided as separate IU's, the railing should use the same separation points.

- Stack structures are measured in **linear feet.**

- Access doors for stack structures are measured in **square feet.**

- Stack caps on stack structures are measured as one **each.**

- Guying systems for stack structures are measured in **linear feet.**

V. UNIT COSTS

The unit costs that are applied to the quantities recorded for each observation are contained within the Site CAIS as repair cost.

VI. STANDARD SAFETY REQUIREMENTS

The Master Safety Plan will be followed at all times during the condition survey.

Inspector may utilize the following protective gear:

- Hard hat - to be worn during all surveys
- Safety glasses - to be worn during all surveys
- Safety shoes - to be worn during all surveys
- Coveralls - to be worn as necessary
- Gloves - to be worn as necessary
- Ear plugs - to be worn in designated areas
- Knee pads - to be worn when crawling is required
- Rain suit - to be worn as necessary
- Wet suit - to be worn as necessary

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VII. STANDARD TOOLS

Employee Identification Card - to be worn or carried during all survey activities
Data Collection Device (DCD)
Battery pack for DCD
Flashlight
Tape measure - 20' (or other supplemental measuring devices)
Screwdrivers - Phillips and straight slot
Pliers
Pocket knife or ice pick
Ladder (when required)
Scraper
Wire brush
Hammer (for sounding)
Calipers
Measuring scales
Binoculars
Dye, paintbrush, developer and rags

VIII. SPECIAL TOOLS AND EQUIPMENT REQUIREMENTS

At the subsystem level, the deficiency standard has identified special tools and equipment required for the standard inspection of the associated components, which exceed the standard tools identified for the system. Level III Inspection Method Guide Sheets will address additional tools and equipment requirements that are specific to that particular advanced method of inspection.

Facility Managers should review these sections in order to determine any special tool requirements for subsystems they are to inspect/survey.

IX. LEVEL II INSPECTION METHOD KEYS

Certain observations will reference a Level II Inspection Method. The Facility Manager will be able to identify deficiencies where a Level II inspection is flagged. The Level II key at the observation level will refer to a specific guide sheet.

All Level II Guide Sheets are located at the end of each Subsystem section. A Guide Sheet Reference page precedes Level II and Level III Guide Sheets.

X. LEVEL III INSPECTION METHOD KEYS

Certain observations will trigger a Level III inspection. The Facility Manager will be able to identify deficiencies where a Level III inspection is flagged. The Level III Key at the observation level will refer to a specific guide sheet. These guide sheets may refer the Facility Manager to a more sophisticated and costly test method.

All Level III Guide Sheets are located at the end of each Subsystem section. A Guide

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Sheet Reference page precedes Level II and Level III Guide Sheets.

XI. REPLACEMENT COST

A replacement cost for each subsystem type will be contained within the cost estimating system in the Site CAIS.

XII. APPENDICES

Appendix A - Abbreviations

A summary and definition of all abbreviations used in this system are contained in Appendix A which is located at the end of Building Superstructure.

Appendix B - Glossary

A glossary of terms used in this system are contained in Appendix B which is located at the end of Building Superstructure.

Appendix C - Life Cycles

A listing of the average life cycle duration for each assembly* in the Standard.

Note - Facility Manager's Guide

The following are included in the Facility Manager's Guide:

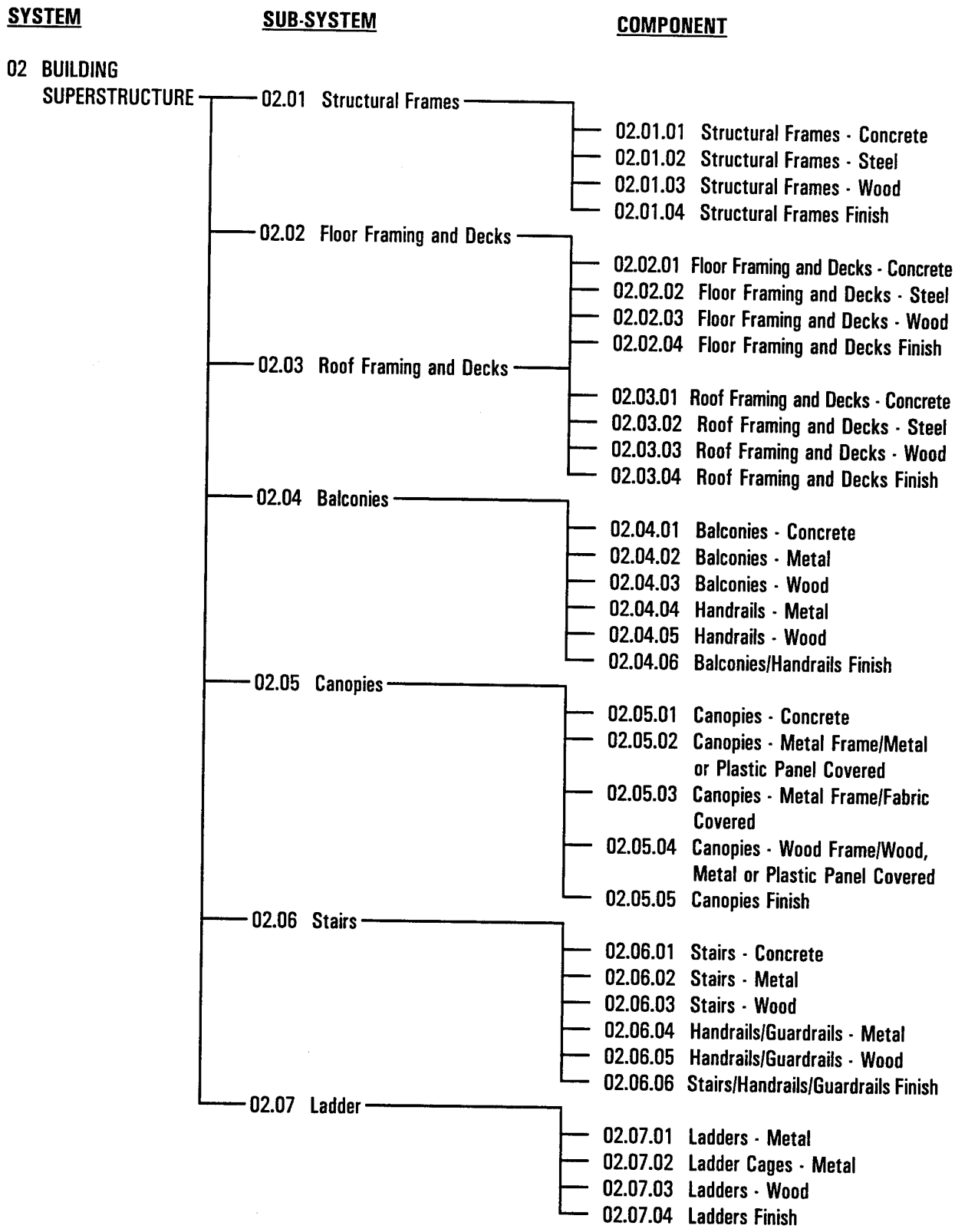
A table showing the required manhours to perform the standard inspection for this facility listed by Cat Code (three digit).

A listing of all Level III inspections with their estimated cost and time to perform. This list will include frequency of inspections for time driven Level III's.

* Assembly is a term describing the level at which replacement rather than repair occurs. This can be at the subsystem or component designation, depending on the system being surveyed.

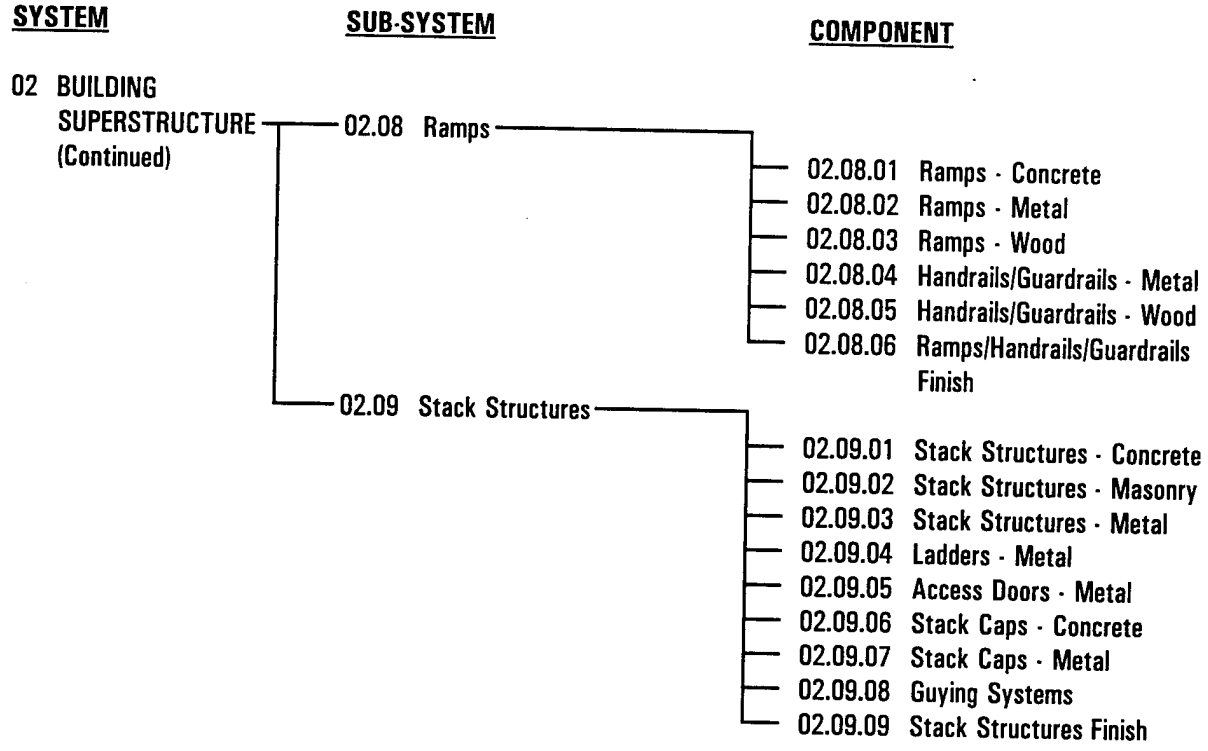
02 BUILDING SUPERSTRUCTURE

Figure 02-A. WORK BREAKDOWN STRUCTURE



02 BUILDING SUPERSTRUCTURE

Figure 02-A. WORK BREAKDOWN STRUCTURE (Continued)



02.01 STRUCTURAL FRAMES

DESCRIPTION

Structural Frames is a subsystem of the Building Superstructure System. A structural frame is the skeleton of a structure that includes load bearing columns, girders, beams, trusses, spandrels, bracing and miscellaneous frame elements.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

The following list of special tools and equipment, beyond the requirements listed in the Standard Tool Section, are required to perform the inspection of Structural Frames:

1. Scraper
2. Wire brush
3. Ice pick or pocket knife
4. Hammer
5. Calipers
6. Measuring scales

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of Structural Frames, beyond the requirements listed in the Master Safety Plan and System Safety Section.

COMPONENT LIST

- 02.01.01 STRUCTURAL FRAMES - CONCRETE
- 02.01.02 STRUCTURAL FRAMES - STEEL
- 02.01.03 STRUCTURAL FRAMES - WOOD
- 02.01.04 STRUCTURAL FRAMES FINISH

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following should be reviewed for concurrent inspection activities.

01.01	FOUNDATION WALLS AND PIERS
01.02	SLABS-ON-GRADE, BASES AND PITS

02.01 STRUCTURAL FRAMES

STANDARD INSPECTION PROCEDURE

This subsystem requires both Level I and Level II inspections as part of the basic inspection process. Additional Level II inspections may be indicated or "triggered" by the Level I inspection observations and should be accomplished by the inspector at that time. Associated defects and observations, for each major component, are listed in the inspectors' Data Collection Devices.

COMPONENTS

◆ 02.01.01 STRUCTURAL FRAMES - CONCRETE

Concrete structural framing includes cast-in-place and pre-cast columns, beams, trusses and miscellaneous frame elements. It is used where function and scale require strength, durability and security, and can be exposed for architectural purpose. Distress of concrete structures is visually displayed as cracking, spalling, scaling and other signs of disintegration. Scaling is usually a finish or curing defect while spalling is a stress defect. Cracking may be the result of either of the above.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking.**			
Observation:			
a. Open cracks, up to 1/16" wide.	LF		
*** {Severity M}			
b. Open cracks, greater than 1/16" in width or exceeding 2" in depth.	LF		1
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF		2
*** {Severity H}			
b. Exposure of reinforcing steel.	SF		2
*** {Severity H}			

02.01 STRUCTURAL FRAMES

COMPONENTS (Continued)

◆ 02.01.01 STRUCTURAL FRAMES - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling and Spalling.**			
Observation:			
a. Scaling of surface up to 1/4" deep.	SF		
*** {Severity L}			
b. Scaling of surface from 1/4" to 1/2" deep with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Spalling more than 1" deep, in beam or column - not at joint or juncture.	SF		1
*** {Severity M}			
d. Scaling of surface exceeding 1/2" deep.	SF		
*** {Severity H}			
e. Spalling more than 1" deep, in beam or column - at joint or juncture.	SF		1

02.01 STRUCTURAL FRAMES

COMPONENTS (Continued)

◆ 02.01.02 STRUCTURAL FRAMES - STEEL

Steel structural framing includes columns, girders, trusses, spandrels and bracing. Connections are vital to the integrity of the structure and are provided by riveting, welding or bolting. A steel frame brings strength, stiffness and dimensional stability. The major disadvantage is corrosion.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		3
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
b. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose/missing bolts, rivets or mechanical fasteners.	EA		
*** {Severity H}			
b. Cracked or broken welds.	EA		3
*** {Severity H}			

02.01 STRUCTURAL FRAMES

COMPONENTS (Continued)

◆ 02.01.03 STRUCTURAL FRAMES - WOOD

Wood framing systems are generally used in housing facilities or temporary structures. They are made up of studs, beams, joists and trusses. Structural lumber is stress-graded for bending and is a minimum of 2" thick and 4" wide. Factors affecting integrity are splits, loose connections, and exposure to moisture, leading to decay or rot. Parasite damage can also cause a structural breakdown.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Soft or crushed area.	SF	1	4
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and frass observed.	SF	1	4
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	SF	1	4
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity M}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing/deteriorated fasteners or anchorage.	EA		
*** {Severity H}			

02.01 STRUCTURAL FRAMES

COMPONENTS (Continued)

◆ 02.01.03 STRUCTURAL FRAMES - WOOD (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracked, or broken.**			
Observation:			
a. Less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Greater than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Broken or deflected.	SF		
*** {Severity H}			

02.01 STRUCTURAL FRAMES

COMPONENTS (Continued)

◆ 02.01.04 STRUCTURAL FRAMES FINISH

Finishes are applied as a thin layer of coating to a substrate by brush, roller, sprayer or other suitable methods. The coating seals, protects or provides the desired appearance.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Finish Damage.**			
Observation:			
a. Finish damage evidenced by mars, scratches, scuffs, fading and discoloration.	SF		
*** {Severity L}			
b. Finish material damage, no exposure of substrate.	SF		
*** {Severity M}			
c. Finish material damage evidenced by exposure of substrate.	SF		
*** {Severity H}			

02.01 STRUCTURAL FRAMES

REFERENCES

1. NAVFAC DM-2, Structural Engineering, 1970
2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
3. NAVFAC MO-312, Wood Protection, 1990
4. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994
5. Architectural Graphic Standards, Seventh Edition, Ramsey/Sleeper, 1981

02.01 STRUCTURAL FRAMES

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
1	GS-II 02.01.03-1

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1	GS-III 02.01.01-1
2	GS-III 02.01.01-2
3	GS-III 02.01.02-3
4	GS-III 02.01.03-4

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: STRUCTURAL FRAMES - WOOD
CONTROL NUMBER: GS-II 02.01.03-1

Application

This guide applies to the investigation of deterioration of wood structures due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

2. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: STRUCTURAL FRAMES - CONCRETE
CONTROL NUMBER: GS-III 02.01.01-1

Application

This guide applies to the investigation of cracks and spalls in concrete structural frames, by a structural engineer/specialist.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage, and if further test are required at this time:
   a. Check general appearance for any conditions that may cause cracking, spalling or surface deterioration.
   b. Examine cracks or spalls to determine if they are active or dormant. Document the location, pattern, depth, width and length.
   c. Perform NDT, such as ultrasonic pulse velocity inspection of the defects to determine extent of subsurface damage.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by a Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: STRUCTURAL FRAMES - CONCRETE
CONTROL NUMBER: GS-III 02.01.01-2

Application

This guide applies to the investigation of corrosion or reinforcing steel in concrete structural frames, by a structural engineer/specialist.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage, and if further test are required at this time:
   a. Check for exposure and environmental conditions, specifically chemical attack.
   b. Check for adequacy of concrete cover to protect it from corrosion.
   c. Perform NDT to determine corrosion activity, such as a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by a Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: STRUCTURAL FRAMES - STEEL
CONTROL NUMBER: GS-III 02.01.02-3

Application

This guide applies to the investigation of cracks and cracked welds in steel structural frames, by a structural engineer/specialist.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage and if further test are required at this time:
   a. Clean area (wire brush) to bare metal.
   b. Apply dye, allow to penetrate, remove excess.
   c. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
   d. Perform NDT, such as high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
   e. Check any other suspect areas such as patches and repairs.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by a Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4

COMPONENT: STRUCTURAL FRAMES - WOOD
CONTROL NUMBER: GS-III 02.01.03-4

Application

This guide applies to the investigation of deterioration of wood structural frames due to insect infestation, rot or fungi damage, by a structural engineer/specialist.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage and if further test are required at this time:
   a. Sound with hammer.
   b. Bore or core (should be angled to prevent water accumulation). Plug hole with treated dowels. Examine core at the site and send to laboratory for biological studies.
   c. Test with a moisture meter.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. One-pound hammer
2. Increment borer
3. Moisture meter
4. Treated wood dowels

Recommended Inspection Frequency

Perform inspection when triggered by a Level I and Level II inspections or other local factors such as problematic conditions.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4 (Continued)

COMPONENT: STRUCTURAL FRAMES - WOOD (Continued)
CONTROL NUMBER: GS-III 02.01.03-4

References

1. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993
2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
3. NAVFAC MO-312, Wood Protection, 1990

02.02 FLOOR FRAMING AND DECKS

DESCRIPTION

Floor Framing and Decks is a subsystem of the Building Superstructure System. Floor framing and decks constitute horizontal platforms establishing stories or levels in a structure. Depending on the design and function of the structure, floor framing and decks may be constructed of concrete, steel, or wood.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

The following list of special tools and equipment, beyond the requirements listed in the Standard Tool Section, are required to perform the inspection of Floor Framing and Decks:

1. Scraper
2. Wire brush
3. Ice pick or pocket knife
4. Hammer
5. Calipers
6. Measuring scales

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of Floor Framing and Decks, beyond the requirements listed in the Master Safety Plan and System Safety Section.

COMPONENT LIST

- 02.02.01 FLOOR FRAMING AND DECKS - CONCRETE
- 02.02.02 FLOOR FRAMING AND DECKS - STEEL
- 02.02.03 FLOOR FRAMING AND DECKS - WOOD
- 02.02.04 FLOOR FRAMING AND DECKS FINISH

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following should be reviewed for concurrent inspection activities.

02.01	STRUCTURAL FRAMES
02.06	STAIRS
02.08	RAMPS

02.02 FLOOR FRAMING AND DECKS

STANDARD INSPECTION PROCEDURE

This subsystem requires both Level I and Level II inspections as part of the basic inspection process. Additional Level II inspections may be indicated or "triggered" by the Level I inspection observations and should be accomplished by the inspector at that time. Associated defects and observations, for each major component, are listed in the inspectors' Data Collection Devices. Since most floors have surface treatments or covering, the inspection can only be made of the underside, where accessible.

COMPONENTS

◆ 02.02.01 FLOOR FRAMING AND DECKS - CONCRETE

A concrete floor is a horizontal platform between two stories. It can be as simple as a flat slab or a system of slabs, beams and columns, and may be constructed of pre-cast panels or poured-in-place concrete. Scaling is usually a finish or curing defect while spalling is a stress defect. Cracking may be the result of either of the above.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking.**			
Observation:			
a. Open cracks, up to 1/16" wide.	LF		
*** {Severity M}			
b. Open cracks, greater than 1/16" in width or exceeding 2" in depth.	LF		1
*** {Severity H}			
c. Extensive disintegration of surface or cracks exceeding depth of 2".	SF		1
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF		2
*** {Severity H}			
b. Exposure of reinforcing steel.	SF		2
*** {Severity H}			

02.02 FLOOR FRAMING AND DECKS

COMPONENTS (Continued)

◆ **02.02.01 FLOOR FRAMING AND DECKS - CONCRETE (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling and Spalling.**			
Observation:			
a. Scaling of surface up to 1/4" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Scaling of surface from 1/4" to 1/2" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Spalling more than 1" deep, in beam or column - not at joint or juncture.	SF		1
*** {Severity M}			
d. Scaling of surface exceeding 1/2" deep.	SF		
*** {Severity H}			
e. Spalling more than 1" deep, in beam or column - at joint or juncture.	SF		1
*** {Severity H}			

02.02 FLOOR FRAMING AND DECKS

COMPONENTS (Continued)

◆ 02.02.02 FLOOR FRAMING AND DECKS - STEEL

Steel floor deck on open-web steel joists is widely used and provides the form for a concrete deck. The steel decking is generally 18 to 22 gauges ribbed or fluted sheet.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking or buckling of frame.**			
Observation:			
a. Deformation, twisting, or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		3
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
b. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose/missing rivets, bolts, or mechanical fasteners.	EA		
*** {Severity H}			
b. Cracked or broken welds.	EA		3
*** {Severity H}			

02.02 FLOOR FRAMING AND DECKS

COMPONENTS (Continued)

◆ 02.02.03 FLOOR FRAMING AND DECKS - WOOD

Wood floor frame and deck consist of joists bridging the sub-flooring and plywood sub-flooring on girders as a base for a floor covering.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Soft or crushed area.	SF	1	4
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and frass observed.	SF	1	4
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	SF	1	4
*** {Severity H}			
*** Deteriorated decking.**			
Observation:			
a. Loose decking.	SF		
*** {Severity L}			
b. Damaged or missing decking.	SF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing/deteriorated fasteners or anchorage.	EA		
*** {Severity H}			

02.02 FLOOR FRAMING AND DECKS

COMPONENTS (Continued)

◆ 02.02.03 FLOOR FRAMING AND DECKS - WOOD (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracked, or broken.**			
Observation:			
a. Less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Greater than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Broken or deflected.	SF		
*** {Severity H}			

02.02 FLOOR FRAMING AND DECKS

COMPONENTS (Continued)

◆ 02.02.04 FLOOR FRAMING AND DECKS FINISH

Finishes are applied as a thin layer of coating to a substrate by brush, roller, sprayer or other suitable methods. The coating seals, protects or provides the desired appearance.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Finish Damage.**			
Observation:			
a. Finish damage evidenced by mars, scratches, scuffs, fading and discoloration.	SF		
*** {Severity L}			
b. Finish material damage, no exposure of substrate.	SF		
*** {Severity M}			
c. Finish material damage evidenced by exposure of substrate.	SF		
*** {Severity H}			

02.02 FLOOR FRAMING AND DECKS

REFERENCES

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

2. NAVFAC MO-312, Wood Protection, 1990

3. Architectural Graphic Standards, Seventh Edition, Ramsey/Sleeper, 1981

4. Means Concrete Repair and Maintenance Illustrated, Peter H. Emmons, 1994

5. Building Design and Construction Handbook, Frederick S. Merritt, 1982

02.02 FLOOR FRAMING AND DECKS

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
1	GS-II 02.02.03-1

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1	GS-III 02.02.01-1
2	GS-III 02.02.01-2
3	GS-III 02.02.02-3
4	GS-III 02.02.03-4

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: FLOOR FRAMING AND DECKS - WOOD
CONTROL NUMBER: GS-II 02.02.03-1

Application

This guide applies to the investigation of deterioration of wood members due to insect infestation, rot, or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area, using scraper and brush.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer, in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick/pocket knife, to determine extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

2. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: FLOOR FRAMING AND DECKS - CONCRETE
CONTROL NUMBER: GS-III 02.02.01-1

Application

This guide applies to the investigation of cracks and spalls in concrete structural frames, by a structural engineer/specialist.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage, and if further test are required at this time:
   a. Check general appearance for any conditions that may cause cracking, spalling or surface deterioration.
   b. Examine cracks or spalls to determine if they are active or dormant. Document the location, pattern, depth, width and length.
   c. Perform NDT, such as ultrasonic pulse velocity inspection of the defects to determine extent of subsurface damage.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by a Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: FLOOR FRAMING AND DECKS - CONCRETE
CONTROL NUMBER: GS-III 02.02.01-2

Application

This guide applies to the investigation of corrosion or reinforcing steel in concrete structural frames, by a structural engineer/specialist.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage, and if further test are required at this time:
   a. Check for exposure and environmental conditions, specifically chemical attack.
   b. Check for adequacy of concrete cover to protect it from corrosion.
   c. Perform NDT to determine corrosion activity, such as a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by a Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: FLOOR FRAMING AND DECKS - STEEL
CONTROL NUMBER: GS-III 02.02.02-3

Application

This guide applies to the investigation of cracks and cracked welds in steel structural frames, by a structural engineer/specialist.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage and if further test are required at this time:
   a. Clean area (wire brush) to bare metal.
   b. Apply dye, allow to penetrate, remove excess.
   c. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
   d. Perform NDT, such as high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
   e. Check any other suspect areas such as patches and repairs.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by a Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4

COMPONENT: FLOOR FRAMING AND DECKS - WOOD
CONTROL NUMBER: GS-III 02.02.03-4

Application

This guide applies to the investigation of deterioration of wood structural frames due to insect infestation, rot or fungi damage, by a structural engineer/specialist of deterioration.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage and if further test are required at this time:
   a. Sound with hammer.
   b. Bore or core (should be angled to prevent water accumulation). Plug hole with treated dowels. Examine core at the site and send to laboratory for biological studies.
   c. Test with a moisture meter.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Increment borers
2. Moisture meter
3. Treated wood dowels
4. One-pound hammer

Recommended Inspection Frequency

Perform inspection when triggered by a Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-312, Wood Protection, 1990
2. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993
3. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

02.03 ROOF FRAMING AND DECKS

DESCRIPTION

Roof Framing and Decks is a subsystem of the Building Superstructure System. The roof framing and decks consist of a horizontal platform supported by framework at the top of a structure. Depending on the design and function of the structure, it may be constructed of concrete, steel or wood, and is designed to accept exterior roof coverings and treatment.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

The following list of special tools and equipment, beyond the requirements listed in the Standard Tool Section, are required to perform the inspection of Roof Framing and Decks:

1. Scraper
2 Wire brush
3. Ice pick or pocket knife
4. Hammer
5. Calipers
6. Measuring scales

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of Roof Framing and Decks, beyond the requirements listed in the Master Safety Plan and System Safety Section.

COMPONENT LIST

- 02.03.01 ROOF FRAMING AND DECKS - CONCRETE
- 02.03.02 ROOF FRAMING AND DECKS - STEEL
- 02.03.03 ROOF FRAMING AND DECKS - WOOD
- 02.03.04 ROOF FRAMING AND DECKS FINISH

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following should be reviewed for concurrent inspection activities.

02.01	STRUCTURAL FRAMES
03.01	EXTERIOR WALL
04	BUILDING ROOFING

02.03 ROOF FRAMING AND DECKS

STANDARD INSPECTION PROCEDURE

This subsystem requires both Level I and Level II inspections as the basic inspection process. Additional Level II inspections may be indicated or "triggered" by the Level I inspection observations and should be accomplished by the inspector at that time. Associated defects and observations, for each major component, are listed in the inspectors' Data Collection Devices. Since the top of the roof is normally covered by roofing materials, the inspection can only be made of the underside, where accessible.

COMPONENTS

◆ 02.03.01 ROOF FRAMING AND DECKS - CONCRETE

A concrete roof is a system of slabs, beams, and columns of cast-in-place or precast concrete. Scaling is usually a finish or curing defect while spalling is a stress defect. Cracking may be the result of either of the above.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking.**			
Observation:			
a. Extensive disintegration of surface or cracks exceeding depth of 2".	SF		1
*** {Severity H}			
b. Open cracks, up to 1/16" wide.	LF		
*** {Severity M}			
c. Open cracks, greater than 1/16" in width or exceeding 2" in depth.	LF		1
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF		2
*** {Severity H}			
b. Exposure of reinforcing steel.	SF		2
*** {Severity H}			

02.03 ROOF FRAMING AND DECKS

COMPONENTS (Continued)

◆ 02.03.01 ROOF FRAMING AND DECKS - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling and Spalling.**			
Observation:			
a. Scaling of surface up to 1/4" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Scaling of surface from 1/4" to 1/2" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Spalling more than 1" deep, in beam or column - not at joint or juncture.	SF		1
*** {Severity M}			
d. Scaling of surface exceeding 1/2" deep.	SF		
*** {Severity H}			
e. Spalling more than 1" deep, in beam or column - at joint or juncture.	SF		1
*** {Severity H}			

02.03 ROOF FRAMING AND DECKS

COMPONENTS (Continued)

◆ 02.03.02 ROOF FRAMING AND DECKS - STEEL

Steel roof decks, manufactured in channel depths ranging from 1 1/2" to 7 1/2", with a thickness of 18 to 22 gauge over open-web joists, are a widely used roof support due to light weight and span flexibility. A steel deck is typically covered by insulation and the exterior roofing treatment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting, or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		3
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
b. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Cracked or broken welds.	EA		3
*** {Severity H}			
a. Loose/missing rivets, bolts, or c mechanical fasteners.	EA		
*** {Severity H}			

02.03 ROOF FRAMING AND DECKS

COMPONENTS (Continued)

◆ 02.03.03 ROOF FRAMING AND DECKS - WOOD

Wood roof frames and decks generally consist of a system including trusses and rafters, with exterior plywood sheathing or wood framing plank applied to the framing as a base for applying roofing materials.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Soft or crushed area.	SF	1	4
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and frass observed.	SF	1	4
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	SF	1	4
*** {Severity H}			
*** Deteriorated decking.**			
Observation:			
a. Loose decking.	SF		
*** {Severity L}			
b. Damaged or missing decking.	SF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing/deteriorated fasteners or anchorage.	EA		
*** {Severity H}			

02.03 ROOF FRAMING AND DECKS

COMPONENTS (Continued)

◆ 02.03.03 ROOF FRAMING AND DECKS - WOOD (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracked, or broken frame.**			
Observation:			
a. Less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Greater than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Broken or deflected.	SF		
*** {Severity H}			

02.03 ROOF FRAMING AND DECKS

COMPONENTS (Continued)

◆ 02.03.04 ROOF FRAMING AND DECKS FINISH

Finishes are applied as a thin layer of coating to a substrate by brush, roller, sprayer or other suitable methods. The coating seals, protects or provides the desired appearance.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Finish Damage.**			
Observation:			
a. Finish damage evidenced by mars, scratches, scuffs, fading and discoloration.	SF		
*** {Severity L}			
b. Finish material damage, no exposure of substrate.	SF		
*** {Severity M}			
c. Finish material damage evidenced by exposure of substrate.	SF		
*** {Severity H}			

02.03 ROOF FRAMING AND DECKS

REFERENCES

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
2. NAVFAC MO-312, Wood Protection, 1990
3. Architectural Graphic Standards, Seventh Edition, Ramsey/Sleeper, 1981
4. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994
5. Building Design and Construction Handbook, Frederick S. Merritt, 1982

02.03 ROOF FRAMING AND DECKS

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
1	GS-II 02.03.03-1

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1	GS-III 02.03.01-1
2	GS-III 02.03.01-2
3	GS-III 02.03.02-3
4	GS-III 02.03.03-4

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: ROOF FRAMING AND DECKS - WOOD
CONTROL NUMBER: GS-II 02.03.03-1

Application

This guide applies to the investigation of deterioration of wood members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

2. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: ROOF FRAMING AND DECKS - CONCRETE
CONTROL NUMBER: GS-III 02.03.01-1

Application

This guide applies to the investigation of cracks and spalls in concrete structural frames, by a structural engineer/specialist.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage, and if further test are required at this time:
   a. Check general appearance for any conditions that may cause cracking, spalling or surface deterioration.
   b. Examine cracks or spalls to determine if they are active or dormant. Document the location, pattern, depth, width and length.
   c. Perform NDT, such as ultrasonic pulse velocity inspection of the defects to determine extent of subsurface damage.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: ROOF FRAMING AND DECKS - CONCRETE
CONTROL NUMBER: GS-III 02.03.01-2

Application

This guide applies to the investigation of corrosion or reinforcing steel in concrete structural frames, by a structural engineer/specialist.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage, and if further test are required at this time:
   a. Check for exposure and environmental conditions, specifically chemical attack.
   b. Check for adequacy of concrete cover to protect it from corrosion.
   c. Perform NDT to determine corrosion activity, such as a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: ROOF FRAMING AND DECKS - STEEL
CONTROL NUMBER: GS-III 02.03.02-3

Application

This guide applies to the investigation of cracks and cracked welds in steel structural frames, by a structural engineer/specialist.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage and if further test are required at this time:
   a. Clean area (wire brush) to bare metal.
   b. Apply dye, allow to penetrate, remove excess.
   c. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
   d. Perform NDT, such as high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
   e. Check any other suspect areas such as patches and repairs.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4

COMPONENT: ROOF FRAMING AND DECKS - WOOD
CONTROL NUMBER: GS-III 02.03.03-4

Application

This guide applies to the investigation of deterioration of wood structural frames due to insect infestation, rot or fungi damage, by a structural engineer/specialist of deterioration.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage and if further test are required at this time:
   a. Sound with hammer.
   b. Bore or core (should be angled to prevent water accumulation). Plug hole with treated dowels. Examine core at the site and send to laboratory for biological studies.
   c. Test with a moisture meter.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Increment borers
2. Moisture meter
3. Treated wood dowels

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-312, Wood Protection, 1990

2. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities 1993

3. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

02.04 BALCONIES

DESCRIPTION

Balconies is a subsystem of the Building Superstructure System. A balcony is a landing or platform that projects from the wall of a building. It can be an interior or exterior balcony, a working balcony (controls and panels) or a cross landing. It is generally complemented with a railing or balustrade.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

The following list of special tools and equipment, beyond the requirements listed in the Standard Tool Section, are required to perform the inspection of Balconies:

1. Scraper
2. Wire brush
3. Ice pick or pocket knife
4. Hammer
5. Calipers
6. Measuring scales

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of Balconies, beyond the requirements listed in the Master Safety Plan and System Safety Section.

COMPONENT LIST

- 02.04.01 BALCONIES - CONCRETE
- 02.04.02 BALCONIES - METAL
- 02.04.03 BALCONIES - WOOD
- 02.04.04 HANDRAILS - METAL
- 02.04.05 HANDRAILS - WOOD
- 02.04.06 HANDRAILS/HANDRAILS FINISH

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following should be reviewed for concurrent inspection activities.

02.01	STRUCTURAL FRAMES
02.02	FLOOR FRAMING AND DECKS
02.03	ROOF FRAMING AND DECKS

02.04 BALCONIES

STANDARD INSPECTION PROCEDURE

This subsystem requires both Level I and Level II inspections as the basic inspection process. Additional Level II inspections may be indicated or "triggered" by the Level I inspection observations and should be accomplished by the inspector at that time. Associated defects and observations, for each major component, are listed in the inspectors' Data Collection Devices. The underside of the balcony shall be inspected from the level below.

COMPONENTS

◆ 02.04.01 BALCONIES - CONCRETE

A concrete balcony is a cantilevered slab. The location of maximum stress and possible structural cracks is where the balcony and building exterior wall meet. Scaling is usually a finish or curing defect while spalling is a stress defect. Cracking may be the result to either of the above.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking.**			
Observation:			
a. Open cracks, up to 1/16" wide.	LF		
*** {Severity M}			
b. Open cracks, greater than 1/16" in width or exceeding 2" in depth.	LF		1
*** {Severity H}			
c. Extensive disintegration of surface or cracks exceeding depth of 2".	SF		1
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF		2
*** {Severity H}			
b. Exposure of reinforcing steel.	SF		2
*** {Severity H}			
*** Improper slope.**			
Observation:			
a. Balcony sloped toward building wall, evidence of drainage problems.	SF		
*** {Severity F}			

02.04 BALCONIES

COMPONENTS (Continued)

◆ **02.04.01 BALCONIES - CONCRETE (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling and Spalling.**			
Observation:			
a. Scaling of surface up to 1/4" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Scaling of surface from 1/4" to 1/2" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Spalling more than 1" deep, in beam or column - not at joint or juncture.	SF		1
*** {Severity M}			
d. Scaling of surface exceeding 1/2" deep.	SF		
*** {Severity H}			
e. Spalling more than 1" deep, in beam or column - at joint or juncture.	SF		1
*** {Severity H}			

02.04 BALCONIES

COMPONENTS (Continued)

◆ 02.04.02 BALCONIES - METAL

A metal balcony can be a projection of beams from a wall with open steel grating as a deck, or a floor of poured concrete or wood over a corrugated metal deck. The location of maximum stress and possible structural cracks is where the balcony and exterior wall of the building meet.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking or buckling of frame.**			
Observation:			
a. Deformation, twisting, or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		3
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
b. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Surface deterioration of deck.**			
Observation:			
a. Cracking or scaling, of concrete.	SF		
*** {Severity L}			
b. Damaged or missing wood decking.	SF		
*** {Severity M}			
c. Damaged or missing grating.	SF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA		3
*** {Severity H}			

02.04 BALCONIES

COMPONENTS (Continued)

◆ 02.04.03 BALCONIES - WOOD

A wood balcony is a cantilevered wood floor beam with a plywood sheath or planking for a deck. The location of maximum stress and possible structural cracks is where the balcony and exterior wall of the building meet.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Soft or crushed area.	SF	1	4
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and frass observed.	SF	1	4
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	SF	1	4
*** {Severity H}			
*** Deteriorated decking.**			
Observation:			
a. Loose decking.	SF		
*** {Severity L}			
b. Damaged or missing decking.	SF		
*** {Severity M}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity M}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			

02.04 BALCONIES

COMPONENTS (Continued)

◆ **02.04.03 BALCONIES - WOOD (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracked, or broken frame.**			
Observation:			
a. Less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Greater than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Broken or deflected.	SF		
*** {Severity H}			

02.04 BALCONIES

COMPONENTS (Continued)

◆ 02.04.04 HANDRAILS - METAL

A metal hand rail system can be a basic design of rails, piping and posts or a decorative balustrade, serving the purpose of guarding an open side of a balcony.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged metal handrails.**			
Observation:			
a. Loose supports or handrails.	LF		
*** {Severity L}			
b. Broken or missing supports or handrails.	LF		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting, or bending.	LF		
*** {Severity H}			
b. Physically damaged member.	LF		
*** {Severity H}			
c. Stress or fatigue cracks.	LF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose bolts, rivets, or mechanical fasteners.	EA		
*** {Severity M}			
b. Cracked or broken welds.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	LF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			

02.04 BALCONIES

COMPONENTS (Continued)

◆ 02.04.05 HANDRAILS - WOOD

A wood hand rail system can be a basic design of structural rails and posts or a decorative balustrade, serving the purpose of guarding an open side of a balcony.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged wooden handrails.**			
Observation:			
a. Loose supports or handrails.	LF		
*** {Severity L}			
b. Broken or missing supports or handrails.	LF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	LF		
*** {Severity M}			
b. Discolored, soft or crushed area.	LF	2	
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and frass observed.	LF	2	
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	LF	2	
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity M}			
b. Missing fasteners or anchorage.	EA		
*** {Severity H}			
c. Broken, split or damaged wood at connection.	EA		
*** {Severity H}			

02.04 BALCONIES

COMPONENTS (Continued)

◆ 02.04.06 BALCONIES/HANDRAILS FINISH

Finishes are applied as a thin layer of coating to a substrate by brush, roller, sprayer or other suitable methods. The coating seals, protects or provides the desired appearance.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Finish Damage.**			
Observation:			
a. Finish damage evidenced by mars, scratches, scuffs, fading and discoloration.	SF		
*** {Severity L}			
b. Finish material damage, no exposure of substrate.	SF		
*** {Severity M}			
c. Finish material damage evidenced by exposure of substrate.	SF		
*** {Severity H}			

02.04 BALCONIES

REFERENCES

1. Uniform Building Code, 1988 Edition

2. Architectural Graphic Standards, Seventh Edition, Ramsey/Sleeper, 1981

3. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

02.04 BALCONIES

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
1	GS-II 02.04.03-1
2	GS-II 02.04.05-2

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1	GS-III 02.04.01-1
2	GS-III 02.04.01-2
3	GS-III 02.04.02-3
4	GS-III 02.04.03-4

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: BALCONIES - WOOD
CONTROL NUMBER: GS-II 02.04.03-1

Application

This guide applies to the investigation of deterioration of wood balconies due to insect infestation, rot, or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by Level I inspection or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

2. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 2

COMPONENT: HANDRAILS - WOOD
CONTROL NUMBER: GS-II 02.04.05-2

Application

This guide applies to the investigation of deterioration of wood handrails due to insect infestation, rot, or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer, in order to detect loss of interior material evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by Level I inspection or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
2. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: BALCONIES - CONCRETE
CONTROL NUMBER: GS-III 02.04.01-1

Application

This guide applies to the investigation of cracks and spalls in concrete structural frames, by a structural engineer/specialist.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage, and if further test are required at this time:
   a. Check general appearance for any conditions that may cause cracking, spalling or surface deterioration.
   b. Examine cracks or spalls to determine if they are active or dormant. Document the location, pattern, depth, width and length.
   c. Perform NDT, such as ultrasonic pulse velocity inspection of the defects to determine extent of subsurface damage.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: BALCONIES - CONCRETE
CONTROL NUMBER: GS-III 02.04.01-2

Application

This guide applies to the investigation of corrosion or reinforcing steel in concrete structural frames, by a structural engineer/specialist.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage, and if further test are required at this time:
   a. Check for exposure and environmental conditions, specifically chemical attack.
   b. Check for adequacy of concrete cover to protect it from corrosion.
   c. Perform NDT to determine corrosion activity, such as a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: BALCONIES - METAL
CONTROL NUMBER: GS-III 02.04.02-3

Application

This guide applies to the investigation of cracks and cracked welds in steel structural frames, by a structural engineer/specialist.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage and if further test are required at this time:
   a. Clean area (wire brush) to bare metal.
   b. Apply dye, allow to penetrate, remove excess.
   c. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
   d. Perform NDT, such as high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
   e. Check any other suspect areas such as patches and repairs.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4

COMPONENT: BALCONIES - WOOD
CONTROL NUMBER: GS-III 02.04.03-4

Application

This guide applies to the investigation of deterioration of wood structural frames due to insect infestation, rot or fungi damage, by a structural engineer/specialist of deterioration.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage and if further test are required at this time:
   a. Sound with hammer.
   b. Bore or core (should be angled to prevent water accumulation). Plug hole with treated dowels. Examine core at the site and send to laboratory for biological studies.
   c. Test with a moisture meter.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Increment borer
2. Moisture meter
3. Treated wood dowels
4. One-pound hammer

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993
2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
3. NAVFAC MO-312, Wood Protection, 1990

02.05 CANOPIES

DESCRIPTION

Canopies is a subsystem of the Building Superstructure System. A canopy is a roof-like structure to provide shade or protection from inclement weather. It can be a projection from a structure over an entrance with the same architectural considerations as the building, or a framing covered with a variety of materials such as metal roofing sheets, fabric, fiberglass or wood. The structural system includes columns, beams, rafters, etc. and has the same framing as roof structures.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

The following list of special tools and equipment, beyond the requirements listed in the Standard Tool Section, are required to perform the inspection of Canopies:

1. Scraper
2. Wire brush
3. Ice pick or pocket knife
4. Hammer
5. Calipers
6. Measuring scales

SPECIAL SAFETY REQUIREMENTS

The following special safety requirements, beyond those listed in the Master Safety Plan and System Safety Section, are necessary to perform the inspection of Canopies.

1. An inspector should not walk on a canopy roof. A combination of high pitch and the potential for instability and damage to the deck or supporting frame makes the canopies dangerous. Walk boards and life lines should be used at all times.
2. An inspector should not walk on any fabric roof.
3. Preferably, inspections of the upper canopy surface should be made from an adjacent structure.

COMPONENT LIST

- 02.05.01 CANOPIES - CONCRETE
- 02.05.02 CANOPIES - METAL FRAME/METAL OR PLASTIC PANEL COVERED
- 02.05.03 CANOPIES - METAL FRAME/FABRIC COVERED
- 02.05.04 CANOPIES - WOOD FRAME/WOOD, METAL OR PLASTIC PANEL COVERED
- 02.05.05 CANOPIES FINISH

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following should be reviewed for concurrent inspection activities:

02.01 STRUCTURAL FRAMES
02.03 ROOF FRAMING AND DECKS

02.05 CANOPIES

STANDARD INSPECTION PROCEDURE

This subsystem requires both Level I and Level II inspections as part of the basic inspection process. Additional Level II inspections may be indicated or "triggered" by the Level I inspection observations and should be accomplished by the inspector at that time. Associated defects and observations, for each major component, are listed in the inspectors' Data Collection Devices.

COMPONENTS

◆ 02.05.01 CANOPIES - CONCRETE

Concrete canopies typically consist of a lightweight concrete roof deck system extending over an entrance to a building or a balcony. They are designed as a slab with supporting columns and beams. Inspection of the canopies shall include all sides of the exposed canopies. Scaling is usually a finish or curing defect while spalling is a stress defect. Cracking may be the result of either of the above.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking.**			
Observation:			
a. Extensive disintegration of surface or cracks exceeding depth of 2".	SF		1
*** {Severity H}			
b. Open cracks, up to 1/16" wide.	LF		
*** {Severity M}			
c. Open cracks, greater than 1/16" in width or exceeding 2" in depth.	LF		1
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF		2
*** {Severity H}			
b. Exposure of reinforcing steel.	SF		2
*** {Severity H}			
*** Improper slope.**			
Observation:			
a. Canopy sloped toward building, evidence of drainage problems.	SF		
*** {Severity F}			

02.05 CANOPIES

COMPONENTS (Continued)

◆ **02.05.01 CANOPIES - CONCRETE (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling and Spalling.**			
Observation:			
a. Scaling of surface up to 1/4" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Scaling of surface from 1/4" to 1/2" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Spalling more than 1" deep, in beam or column - not at joint or juncture.	SF		1
*** {Severity M}			
d. Scaling of surface exceeding 1/2" deep.	SF		
*** {Severity H}			
e. Spalling more than 1" deep, in beam or column - at joint or juncture.	SF		1
*** {Severity H}			

02.05 CANOPIES

COMPONENTS (Continued)

◆ 02.05.02 CANOPIES - METAL FRAME/METAL OR PLASTIC PANEL COVERED

Metal canopy systems are similar to standard metal roofing systems when built as an overhang or extension from an existing structure. They can also be a free standing system of metal framing and metal or plastic panel covering.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking or buckling of frame.**			
Observation:			
a. Deformation, twisting, or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		3
*** {Severity H}			
*** Corrosion of frame.**			
Observation:			
a. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
b. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			
*** Defective frame connections/anchorage.**			
Observation:			
a. Cracked or broken welds.	EA		3
*** {Severity H}			
b. Loose/missing bolts, rivets or mechanical fasteners.	EA		
*** {Severity H}			

02.05 CANOPIES

COMPONENTS (Continued)

◆ 02.05.02 CANOPIES - METAL FRAME/METAL OR PLASTIC PANEL COVERED (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Panel damage or deterioration.**			
Observation:			
a. Deteriorated or missing protective coating, some corrosion evident.	SF		
*** {Severity M}			
b. Bent or warped panels, no obvious water penetration or ponding.	SF		
*** {Severity M}			
c. Bent or warped panels, obvious water penetration or ponding.	SF		
*** {Severity H}			
d. Cracks, holes or punctures in panel, obvious water penetration.	SF		
*** {Severity H}			
*** Panel lap and seam deficiencies.**			
Observation:			
a. Damaged or bent seams, no obvious water penetration.	LF		
*** {Severity L}			
b. Missing or separated panel end lap sealant.	LF		
*** {Severity M}			
c. Damaged or open seam/lap, obvious water penetration.	LF		
*** {Severity H}			
d. Missing or loose end/top closure strips.	LF		
*** {Severity H}			
*** Panel fastener deficiencies.**			
Observation:			
a. Scattered, loose or missing fasteners, potential for panel damage.	EA		
*** {Severity M}			
b. Loose or missing panel fasteners, panel damage imminent.	EA		
*** {Severity H}			

02.05 CANOPIES

COMPONENTS (Continued)

◆ 02.05.03 CANOPIES - METAL FRAME/FABRIC COVERED

Metal frame canopies with fabric coverings are normally installed at entrances to buildings. Inspections of these canopies shall include the metal frame, the fabric and the lashing.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking or buckling of frame.**			
Observation:			
a. Deformation, twisting, or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		
*** {Severity H}			
*** Corrosion of frame.**			
Observation:			
a. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
b. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			
*** Defective frame connections/anchorage.**			
Observation:			
a. Cracked or broken welds.	EA		
*** {Severity H}			
b. Loose/missing bolts, rivets, or mechanical fasteners.	EA		
*** {Severity H}			

02.05 CANOPIES

COMPONENTS (Continued)

◆ 02.05.04 CANOPIES - WOOD FRAME/WOOD, METAL OR PLASTIC PANEL COVERED

A wood canopy consists of wooden structural framing with a variety of covering. It can be an extension of a building or free standing. Coverings can be wood, metal roofing, fiberglass or fabric. Structural integrity is affected by split or broken members or those whose dimensions have been affected by decay or parasite damage.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Soft or crushed area.	SF	1	4
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and frass observed.	SF	1	4
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	SF	1	4
*** {Severity H}			
*** Defective frame connections/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity M}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing/deteriorated fasteners or anchorage.	EA		
*** {Severity H}			

02.05 CANOPIES

COMPONENTS (Continued)

◆ 02.05.04 CANOPIES - WOOD FRAME/WOOD, METAL OR PLASTIC PANEL COVERED (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Panel damage or deterioration.**			
Observation:			
a. Deteriorated or missing protective coating, some corrosion evident.	SF		
*** {Severity M}			
b. Bent or warped panels, no obvious water penetration or ponding.	SF		
*** {Severity M}			
c. Bent or warped panels, obvious water penetration or ponding.	SF		
*** {Severity H}			
d. Cracks, holes or punctures in panel, obvious water penetration.	SF		
*** {Severity H}			
*** Panel lap and seam deficiencies.**			
Observation:			
a. Damaged or bent seams, no obvious water penetration.	LF		
*** {Severity L}			
b. Missing or separated panel end lap sealant.	LF		
*** {Severity M}			
c. Damaged or open seam/lap, obvious water penetration.	LF		
*** {Severity H}			
d. Missing or loose end/top closure strips.	LF		
*** {Severity H}			
*** Panel fastener deficiencies.**			
Observation:			
a. Scattered, loose or missing fasteners, potential for panel damage.	SF		
*** {Severity M}			
b. Loose or missing panel fasteners, panel damage imminent.	SF		
*** {Severity H}			

02.05 CANOPIES

COMPONENTS (Continued)

◆ 02.05.04 CANOPIES - WOOD FRAME/WOOD, METAL OR PLASTIC COVERED (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective fabric coverings.**			
Observation:			
a. Loose or missing cording.	LF		
*** {Severity M}			
b. Sagging fabric.	SF		
*** {Severity M}			
c. Open seams or torn fabric.	SF		
*** {Severity H}			
*** Deteriorated wood coverings.**			
Observation:			
a. Loose covering. {Severity L}	SF		
b. Damaged or missing covering. {Severity M}	SF		
*** Cracked, or broken frame.**			
Observation:			
a. Less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Greater than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Broken or deflected.	SF		
*** {Severity H}			

02.05 CANOPIES

COMPONENTS (Continued)

◆ 02.05.05 CANOPIES FINISH

Finishes are applied as a thin layer of coating to a substrate by brush, roller, sprayer or other suitable methods. The coating seals, protects or provides the desired appearance.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Finish Damage.**			
Observation:			
a. Finish damage evidenced by mars, scratches, scuffs, fading and discoloration.	SF		
*** {Severity L}			
b. Finish material damage, no exposure of substrate.	SF		
*** {Severity M}			
c. Finish material damage evidenced by exposure of substrate.	SF		
*** {Severity H}			

02.05 CANOPIES

REFERENCES

1. NAVFAC MO-312, Wood Protection, 1990
2. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994
3. Architectural Graphic Standards, Seventh Edition, Ramsey/Sleeper, 1981

02.05 CANOPIES

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
1	GS-II 02.05.04-1

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1	GS-III 02.05.01-1
2	GS-III 02.05.01-2
3	GS-III 02.05.02-3
4	GS-III 02.05.04-4

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: CANOPIES - WOOD FRAME/WOOD, METAL OR PLASTIC PANEL COVERED

CONTROL NUMBER: GS-II 02.05.04-1

Application.

This guide applies to the investigation of deterioration of wood canopies due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by Level I inspection or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

2. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: CANOPIES - CONCRETE
CONTROL NUMBER: GS-III 02.05.01-1

Application

This guide applies to the investigation of cracks and spalls in concrete structural frames, by a structural engineer/specialist.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage, and if further test are required at this time:
   a. Check general appearance for any conditions that may cause cracking, spalling or surface deterioration.
   b. Examine cracks or spalls to determine if they are active or dormant. Document the location, pattern, depth, width and length.
   c. Perform NDT, such as ultrasonic pulse velocity inspection of the defects to determine extent of subsurface damage.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: CANOPIES - CONCRETE
CONTROL NUMBER: GS-III 02.05.01-2

Application

This guide applies to the investigation of corrosion or reinforcing steel in concrete, by a structural engineer/specialist.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage, and if further test are required at this time:
   a. Check for exposure and environmental conditions, specifically chemical attack.
   b. Check for adequacy of concrete cover to protect it from corrosion.
   c. Perform NDT to determine corrosion activity, such as a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: CANOPIES - METAL FRAME/METAL OR PLASTIC PANEL COVERED
CONTROL NUMBER: GS-III 02.05.02-3

Application

This guide applies to the investigation of cracks and cracked welds in steel structural frames, by a structural engineer/specialist.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage and if further test are required at this time:
   a. Clean area (wire brush) to bare metal.
   b. Apply dye, allow to penetrate, remove excess.
   c. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
   d. Perform NDT, such as high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
   e. Check any other suspect areas such as patches and repairs.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: CANOPIES - METAL FRAME/METAL OR PLASTIC PANEL COVERED
CONTROL NUMBER: GS-III 02.05.02-3

Application

This guide applies to the investigation of cracks and cracked welds in steel structural frames, by a structural engineer/specialist.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage and if further test are required at this time:
   a. Clean area (wire brush) to bare metal.
   b. Apply dye, allow to penetrate, remove excess.
   c. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
   d. Perform NDT, such as high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
   e. Check any other suspect areas such as patches and repairs.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4

COMPONENT: CANOPIES - WOOD FRAME/WOOD, METAL OR PLASTIC PANEL COVERED
CONTROL NUMBER: GS-III 02.05.04-4

Application

This guide applies to the investigation of deterioration of wood structural frames due to insect infestation, rot or fungi damage, by a structural engineer/specialist of deterioration.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage and if further test are required at this time:
   a. Sound with hammer.
   b. Bore or core (should be angled to prevent water accumulation). Plug hole with treated dowels. Examine core at the site and send to laboratory for biological studies.
   c. Test with a moisture meter.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Increment borer
2. Moisture meter
3. Treated wood dowels
4. One-pound hammer

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-312, Wood Protection, 1990

02.06 STAIRS

DESCRIPTION

Stairs is a subsystem of the Building Superstructure System. Stairs consist of a series of steps connected by landings, for passage from one elevation to another, and the supporting structure. Stairs may be constructed of concrete, metal or wood, and normally have a guardrail or handrail, constructed of metal or wood, attached along the edges. Stairs may be found on the interior or exterior of a structure.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

The following is a list of special tools and equipment, beyond the requirements listed in the Standard Tool Section, that are required to perform the inspection of Stairs.

1. Scraper
2. Wire brush
3. Ice pick or pocket knife
4. Hammer
5. Calipers
6. Measuring scales

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of Stairs, beyond the requirements listed in the Master Safety Plan and System Safety Section.

COMPONENT LIST

- 02.06.01 STAIRS - CONCRETE
- 02.06.02 STAIRS - METAL
- 02.06.03 STAIRS - WOOD
- 02.06.04 HANDRAILS/GUARDRAILS - METAL
- 02.06.05 HANDRAILS/GUARDRAILS - WOOD
- 02.06.06 STAIRS/HANDRAILS/GUARDRAILS FINISH

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following should be reviewed for concurrent inspection activities.

02.01	STRUCTURAL FRAMES
02.02	FLOOR FRAMING AND DECKS

02.06 STAIRS

STANDARD INSPECTION PROCEDURE

This subsystem requires both Level I and Level II inspections as the basic inspection process. Additional Level II inspections may be indicated or "triggered" by the Level I inspection observations and should be accomplished by the inspector at that time. Associated defects and observations, for each major component, are listed in the inspectors' Data Collection Devices.

COMPONENTS

◆ 02.06.01 STAIRS - CONCRETE

Concrete stairs can be cast-in-place or precast. The most common are of the "straight stair" design. The tread should receive non-slip treatments and/or non-slip nosings of various materials. Beams and columns should be closely examined for structural cracks. Scaling is usually a finish or curing defect while spalling is a stress defect. Cracking may be the result of either of the above.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking.**			
Observation:			
a. Extensive disintegration of surface or cracks exceeding depth of 2".	SF		1
*** {Severity H}			
b. Open cracks, up to than 1/16" wide.	LF		
*** {Severity M}			
c. Wide cracks, greater than 1/16" in width or exceeding 2" in depth.	LF		1
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rust/discoloration evident, cracks occurring parallel to reinforcement.	SF		2
*** {Severity H}			
b. Exposure or reinforcing steel.	SF		2
*** {Severity H}			
*** Deterioration/damage of tread surface or nosing.**			
Observation:			
a. Non-slip treatments worn.	EA		
*** {Severity L}			
b. Nosing loose.	EA		
*** {Severity L}			

02.06 STAIRS

COMPONENTS (Continued)

◆ 02.06.01 STAIRS - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling and Spalling.**			
Observation:			
a. Scaling of surface up to 1/4" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Scaling of surface from 1/4" to 1/2" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Spalling more than 1" deep, in beam or column - not at joint or juncture.	SF		1
*** {Severity M}			
d. Scaling of surface exceeding 1/2" deep.	SF		
*** {Severity H}			
e. Spalling more than 1" deep, in beam or column - at joint or juncture.	SF		1
*** {Severity H}			

02.06 STAIRS

COMPONENTS (Continued)

◆ 02.06.02 STAIRS - METAL

The treads of a metal stairway are usually fabricated with grating, safety tread, checkered plate or a pan with concrete fill and nosing.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting, or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		3
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose/missing bolts, rivets or mechanical fasteners.	EA		
*** {Severity H}			
b. Cracked or broken welds.	EA		3
*** {Severity H}			
*** Surface deterioration.**			
Observation:			
a. Cracking or scaling, of concrete.	EA		
*** {Severity L}			
b. Damaged or missing tread.	EA		
*** {Severity M}			
c. Damaged or missing grating.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
b. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			

02.06 STAIRS

COMPONENTS (Continued)

◆ 02.06.03 STAIRS - WOOD

Wooden stairs are usually found in a wood-framed building. They may be built in place or shop fabricated.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connections/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity M}			
b. Broken, split or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Soft or crushed area.	SF	1	4
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and frass observed.	SF	1	4
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures and crushing.	SF	1	4
*** {Severity H}			
*** Deterioration/damage of tread surface.**			
Observation:			
a. Non-slip treatments worn.	EA		
*** {Severity L}			

02.06 STAIRS

COMPONENTS (Continued)

◆ 02.06.03 STAIRS - WOOD (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Cracked, or broken frame.**			
Observation:			
a. Less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Greater than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Broken or deflected.	SF		
*** {Severity H}			

02.06 STAIRS

COMPONENTS (Continued)

◆ 02.06.04 HANDRAILS/GUARDRAILS - METAL

A handrail or guardrail is a safety barrier that extends at a convenient height for a handhold.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged metal handrails/guardrails.**			
Observation:			
a. Loose supports or handrails.	LF		
*** {Severity L}			
b. Broken or missing supports or handrails.	LF		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting, or bending.	LF		
*** {Severity H}			
b. Physically damaged member.	LF		
*** {Severity H}			
c. Stress or fatigue cracks.	LF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Cracked or broken welds.	EA		
*** {Severity H}			
b. Loose/missing bolts, rivets, or mechanical fasteners.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
b. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			

02.06 STAIRS

COMPONENTS (Continued)

◆ 02.06.05 HANDRAILS/GUARDRAILS - WOOD

A handrail or guardrail is a safety barrier that extends at a convenient height for a handhold.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged wooden handrails/guardrails.**			
Observation:			
a. Loose supports or handrails.	LF		
*** {Severity L}			
b. Broken or missing supports or handrails.	LF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	LF		
*** {Severity M}			
b. Soft or crushed area.	LF	2	
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and frass observed.	LF	2	
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	LF	2	
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity M}			
b. Broken, split or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			

02.06 STAIRS

COMPONENTS (Continued)

◆ 02.06.06 STAIRS/HANDRAILS/GUARDRAILS FINISH

Finishes are applied as a thin layer of coating to a substrate by brush, roller, sprayer or other suitable methods. The coating seals, protects or provides the desired appearance.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Finish Damage.**			
Observation:			
a. Finish damage evidenced by mars, scratches, scuffs, fading and discoloration.	SF		
*** {Severity L}			
b. Finish material damage, no exposure of substrate.	SF		
*** {Severity M}			
c. Finish material damage evidenced by exposure of substrate.	SF		
*** {Severity H}			

02.06 STAIRS

REFERENCES

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
2. NAVFAC MO-312, Wood Protection, 1990
3. Building Design and Construction Handbook, Frederick S. Merritt, 1982
4. Architectural Graphic Standards, Seventh Edition, Ramsey/Sleeper, 1981

02.06 STAIRS

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
1	GS-II 02.06.03-1
2	GS-II 02.06.05-2

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1	GS-III 02.06.01-1
2	GS-III 02.06.01-2
3	GS-III 02.06.02-3
4	GS-III 02.06.03-4

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: STAIRS - WOOD
CONTROL NUMBER: GS-II 02.06.03-1

Application

This guide applies to the investigation of deterioration of wood stairs due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by Level I inspection or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
2. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 2

COMPONENT: HANDRAILS/GUARDRAILS - WOOD
CONTROL NUMBER: GS-II 02.06.05-2

Application

This guide applies to the investigation of deterioration of wood handrails/guardrails due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
2. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: STAIRS - CONCRETE
CONTROL NUMBER: GS-III 02.06.01-1

Application

This guide applies to the investigation of cracks and spalls in concrete structural frames, by a structural engineer/specialist.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage, and if further test are required at this time:
   a. Check general appearance for any conditions that may cause cracking, spalling or surface deterioration.
   b. Examine cracks or spalls to determine if they are active or dormant. Document the location, pattern, depth, width and length.
   c. Perform NDT, such as ultrasonic pulse velocity inspection of the defects to determine extent of subsurface damage.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: STAIRS - CONCRETE
CONTROL NUMBER: GS-III 02.06.01-2

Application

This guide applies to the investigation of corrosion or reinforcing steel in concrete structural frames, by a structural engineer/specialist.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage, and if further test are required at this time:
   a. Check for exposure and environmental conditions, specifically chemical attack.
   b. Check for adequacy of concrete cover to protect it from corrosion.
   c. Perform NDT to determine corrosion activity, such as a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: STAIRS - METAL
CONTROL NUMBER: GS-III 02.06.02-3

Application

This guide applies to the investigation of cracks and cracked welds in steel structural frames, by a structural engineer/specialist.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage and if further test are required at this time:
   a. Clean area (wire brush) to bare metal.
   b. Apply dye, allow to penetrate, remove excess.
   c. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
   d. Perform NDT, such as high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
   e. Check any other suspect areas such as patches and repairs.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4

COMPONENT: STAIRS - WOOD
CONTROL NUMBER: GS-III 02.06.03-4

Application

This guide applies to the investigation of deterioration of wood structural frames due to insect infestation, rot or fungi damage, by a structural engineer/specialist of deterioration.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage and if further test are required at this time:
   a. Sound with hammer.
   b. Bore or core (should be angled to prevent water accumulation). Plug hole with treated dowels. Examine core at the site and send to laboratory for biological studies.
   c. Test with a moisture meter.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Increment borer
2. Moisture meter
3. Treated wood dowels

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-312, Wood Protection, 1990

02.07 LADDERS

DESCRIPTION

Ladders is a subsystem of the Building Superstructure System. Ladders are means of vertical access to various parts of a structure not accessible by stairs or ramps. Exterior ladders are normally metal and includes safety cages above 16 FT. Interior ladders can be either metal or wood.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

The following is a list of special tools and equipment, beyond the requirements listed in the Standard Tool Section, that are required to perform the inspection of Ladders:

1. Scraper
2. Wire brush
3. Ice pick or pocket knife
4. Hammer
5. Calipers
6. Measuring scales
7. Dye, paintbrush, developer and rags

SPECIAL SAFETY REQUIREMENTS

The following special safety requirements, beyond those listed in the Master Safety Plan and System Safety Section, are necessary to perform the inspection of Ladders:

1. Wood ladders require care when climbing, because of the unknown condition of the wood.
2. Wood and metal rungs should be checked to see if they can support the inspector's weight.
3. Safety belts are required while performing ladder inspections.

COMPONENT LIST

- 02.07.01 LADDERS - METAL
- 02.07.02 LADDER CAGES - METAL
- 02.07.03 LADDERS - WOOD
- 02.07.04 LADDERS FINISH

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following should be reviewed for concurrent inspection activities.

02.01	STRUCTURAL FRAMES
03.01	EXTERIOR WALL
05.01	INTERIOR PARTITION

02.07 LADDERS

STANDARD INSPECTION PROCEDURE

This subsystem requires both Level I and Level II inspections as the basic inspection process. Additional Level II inspections may be indicated or "triggered" by the Level I inspection observations and should be accomplished by the inspector at that time. Associated defects and observations, for each major component, are listed in the inspectors' Data Collection Devices.

COMPONENTS

◆ 02.07.01 LADDERS - METAL

A metal ladder typically is 18" wide with 3/4" diameter rungs spaced 12" on-center with wall brackets maintaining a 7" clearance.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connections/anchorage.**			
Observation:			
a. Loose/missing bolts, rivets, or mechanical fasteners.	EA		
*** {Severity H}			
b. Cracked or broken welds.	EA		1
*** {Severity H}			
*** Cracking or buckling of frame.**			
Observation:			
a. Deformation, twisting, or bending.	LF		
*** {Severity H}			
b. Physically damaged member.	LF		
*** {Severity H}			
c. Stress or fatigue cracks.	LF		1
*** {Severity H}			
d. Missing rungs.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
b. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			

02.07 LADDERS

COMPONENTS

◆ 02.07.02 LADDER CAGES - METAL

Ladder safety cages encircle metal ladders. They are typically 30" in diameter with horizontal and vertical metal rails.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connections/anchorage.**			
Observation:			
a. Loose/missing bolts, rivets, or mechanical fasteners.	EA		
*** {Severity H}			
b. Cracked or broken welds.	EA		2
*** {Severity H}			
*** Cracking or buckling of frame.**			
Observation:			
a. Deformation, twisting, or bending.	LF		
*** {Severity H}			
b. Physically damaged member.	LF		
*** {Severity H}			
c. Stress or fatigue cracks.	LF		2
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
b. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			

02.07 LADDERS

COMPONENTS

◆ 02.07.03 LADDERS - WOOD

Wooden ladders are typically constructed with side rails of 2" nominal thickness and rungs of 1-5/32" diameter. The wooden rungs may be reinforced with steel rods.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connections/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity M}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	LF		
*** {Severity M}			
b. Soft or crushed area.	LF	1	
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and frass observed.	LF	1	
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, crushing.	LF	1	
*** {Severity H}			
*** Cracked, or broken frame.**			
Observation:			
a. Less than 25 percent of thickness affected.	SF		
*** {Severity M}			
b. Greater than 25 percent of thickness affected.	SF		
*** {Severity H}			
c. Broken or deflected.	SF		
*** {Severity H}			
d. Missing rungs.	EA		
*** {Severity H}			

02.07 LADDERS

COMPONENTS (Continued)

◆ 02.07.04 LADDERS FINISH

Finishes are applied as a thin layer of coating to a substrate by brush, roller, sprayer or other suitable methods. The coating seals, protects or provides the desired appearance.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Finish Damage.**			
Observation:			
a. Finish damage evidenced by mars, scratches, scuffs, fading and discoloration.	SF		
*** {Severity L}			
b. Finish material damage, no exposure of substrate.	SF		
*** {Severity M}			
c. Finish material damage evidenced by exposure of substrate.	SF		
*** {Severity H}			

02.07 LADDERS

REFERENCES

1. NAVFAC MO-312, Wood Protection, 1990

2. Architectural Graphic Standards, Seventh Edition, Ramsey/Sleeper, 1981

02.07 LADDERS

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
1	GS-II 02.07.03-1

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1	GS-III 02.07.01-1
2	GS-III 02.07.02-2

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: LADDERS - WOOD
CONTROL NUMBER: GS-II 02.07.03-1

Application

This guide applies to the investigation of deterioration of wood ladders due to insect infestation, rot, or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by Level I inspection or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

2. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: LADDERS - METAL
CONTROL NUMBER: GS-III 02.07.01-1

Application

This guide applies to the investigation of cracks or cracked welds in metal ladders.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
4. Check any other suspect areas such as patches and repairs.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Architectural Graphic Standards, Seventh Edition, Ramsey/Sleeper, 1981

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: LADDER CAGES - METAL
CONTROL NUMBER: GS-III 02.07.02-2

Application

This guide applies to the investigation of cracks or cracked welds in metal ladders cages.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
4. Perform NDT, in this case high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
5. Check any other suspect areas such as patches and repairs.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Architectural Graphic Standards, Seventh Edition, Ramsey/Sleeper, 1981

02.08 RAMPS

DESCRIPTION

Ramps is a subsystem of the Building Superstructure System. A ramp is an inclined plane, constructed of concrete, metal or wood, used in place of steps. It is found within or adjacent to a structure. Ramps normally have a guardrail or handrail, constructed of metal or wood, attached to the outer edges.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

The following is a list of special tools and equipment, beyond the requirements listed in the Standard Tool Section, that are required to perform the inspection of Ramps.

1. Scraper
2. Brush
3. Ice pick/probe
4. Hammer
5. Calipers
6. Measuring scales

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of Ramps, beyond the requirements listed in the Master Safety Plan and System Safety Section.

COMPONENT LIST

- 02.08.01 RAMPS - CONCRETE
- 02.08.02 RAMPS - METAL
- 02.08.03 RAMPS - WOOD
- 02.08.04 HANDRAILS/GUARDRAILS - METAL
- 02.08.05 HANDRAILS/GUARDRAILS - WOOD
- 02.08.06 RAMPS/HANDRAILS/GUARDRAILS FINISH

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following should be reviewed for concurrent inspection activities.

02.01	STRUCTURAL FRAMES
02.02	FLOOR FRAMING AND DECKS
05.01	INTERIOR PARTITION

02.08 RAMPS

STANDARD INSPECTION PROCEDURE

This subsystem requires both Level I and Level II inspections as the basic inspection process. Additional Level II inspections may be indicated or "triggered" by the Level I inspection observations and should be accomplished by the inspector at that time. Associated defects and observations, for each major component, are listed in the inspectors' Data Collection Devices.

COMPONENTS

◆ 02.08.01 RAMPS - CONCRETE

A concrete ramp is an inclined passageway facilitating elevation changes. It consists of precast or monolithic cast-in-place reinforced concrete. Concrete ramps are generally found in areas of vehicular traffic within or adjacent to a structure. Scaling is usually a finish or curing defect while spalling is a stress defect. Cracking may be the result of either of the above.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking.**			
Observation:			
a. Extensive disintegration of surface or cracks exceeding depth of 2".	SF		1
*** {Severity H}			
b. Open cracks, up to than 1/16" wide.	LF		
*** {Severity M}			
f. Wide cracks, greater than 1/16" in c. width or exceeding 2" in depth.	LF		1
*** {Severity H}			
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement.	SF		2
*** {Severity H}			
b. Exposure of reinforcing steel.	SF		2
*** {Severity H}			
*** Improper slope.**			
Observation:			
a. Ramp sloped toward building wall, evidence of drainage problems.	SF		
*** {Severity F}			

02.08 RAMPS

COMPONENTS (Continued)

◆ **02.08.01 RAMPS - CONCRETE (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Rough transition to upper surface.**			
Observation:			
a. Top elevation of ramp more than 1/2" higher or lower than elevation of upper surface at transition.	LF		
*** {Severity H}			
*** Vertical Displacement.**			
Observation:			
a. Variation from level less than 1".	SF		
*** {Severity L}			
b. Variation from level 1" to 2".	SF		
*** {Severity M}			
c. Variation from level of more than 2".	SF		
*** {Severity H}			
*** Scaling and Spalling.**			
Observation:			
a. Scaling of surface up to 1/4" deep, with exposure of coarse aggregates.	SF		
*** {Severity L}			
b. Scaling of surface from 1/4" to 1/2" deep, with coarse aggregates clearly exposed.	SF		
*** {Severity M}			
c. Spalling more than 1" deep, in beam or column - not at joint or juncture.	SF		1
*** {Severity M}			
d. Scaling of surface exceeding 1/2" deep.	SF		
*** {Severity H}			
e. Spalling more than 1" deep, in beam or column - at joint or juncture.	SF		1
*** {Severity H}			

02.08 RAMPS

COMPONENTS (Continued)

◆ 02.08.02 RAMPS - METAL

A metal ramp consists of a metal frame with a metal plate or grate decking, usually with a rubberized runner or safety tread. Any deformation that could lead to cracks should be closely examined.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting, or bending.	SF		
*** {Severity H}			
b. Physically damaged member.	SF		
*** {Severity H}			
c. Stress or fatigue cracks.	SF		3
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
b. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Surface deterioration.**			
Observation:			
a. Damaged or missing safety tread/ runner.	SF		
*** {Severity M}			
b. Damaged or missing grating.	SF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Cracked or broken welds.	EA		3
*** {Severity H}			
b. Loose/missing bolts, rivets, or mechanical fasteners.	EA		
*** {Severity H}			

02.08 RAMPS

COMPONENTS (Continued)

◆ 02.08.03 RAMPS - WOOD

A wooden ramp consists of a wood frame with wood sheathing or plank decking. The surface would normally have a treatment or covering. Structural integrity is affected by split, cracked or broken members, or those whose dimensions have been affected by decay or parasite damage.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	SF		
*** {Severity M}			
b. Soft or crushed area.	SF	1	4
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and frass observed.	SF	1	4
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	SF	1	4
*** {Severity H}			
*** Surface deterioration.**			
Observation:			
a. Loose, damaged, or missing covering.	SF		
*** {Severity L}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose or rotten wood at connection.	EA		
*** {Severity L}			
b. Broken, split, or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing/deteriorated fasteners or anchorage.	EA		
*** {Severity H}			

02.08 RAMPS

COMPONENTS (Continued)

◆ 02.08.04 HANDRAILS/GUARDRAILS - METAL

A handrail or guardrail is a safety barrier that extends at a convenient height for a handhold.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged metal handrails/guardrails.**			
Observation:			
a. Loose supports or handrails.	LF		
*** {Severity L}			
b. Broken or missing supports or handrails.	LF		
*** {Severity H}			
*** Cracking or buckling.**			
Observation:			
a. Deformation, twisting, or bending.	LF		
*** {Severity H}			
b. Physically damaged member.	LF		
*** {Severity H}			
c. Stress or fatigue cracks.	LF		
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose/missing bolts, rivets, or mechanical fasteners.	EA		
*** {Severity H}			
b. Cracked or broken welds.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
b. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			

02.08 RAMPS

COMPONENTS (Continued)

◆ 02.08.05 HANDRAILS/GUARDRAILS - WOOD

A handrail or guardrail is a safety barrier that extends at a convenient height for a handhold.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged wooden handrails/guardrails.**			
Observation:			
a. Loose supports or handrails.	LF		
*** {Severity L}			
b. Broken or missing supports or handrails.	LF		
*** {Severity H}			
*** Rot, fungus or decay.**			
Observation:			
a. Moist stained area.	LF		
*** {Severity M}			
b. Soft or crushed area.	LF	2	
*** {Severity H}			
*** Parasite damage.**			
Observation:			
a. Holes less than 1/8" diameter, surface sag, and frass observed.	LF	2	
*** {Severity M}			
b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing.	LF	2	
*** {Severity H}			
*** Defective connections/anchorage.**			
Observation:			
a. Loose wood at connection.	EA		
*** {Severity L}			
b. Broken, split or damaged wood at connection.	EA		
*** {Severity H}			
c. Missing fasteners or anchorage.	EA		
*** {Severity H}			

02.08 RAMPS

COMPONENTS (Continued)

◆ 02.08.06 RAMPS/HANDRAILS/GUARDRAILS FINISH

Finishes are applied as a thin layer of coating to a substrate by brush, roller, sprayer or other suitable methods. The coating seals, protects or provides the desired appearance.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Finish Damage.**			
Observation:			
a. Finish damage evidenced by mars, scratches, scuffs, fading and discoloration.	SF		
*** {Severity L}			
b. Finish material damage, no exposure of substrate.	SF		
*** {Severity M}			
c. Finish material damage evidenced by exposure of substrate.	SF		
*** {Severity H}			

02.08 RAMPS

REFERENCES

1. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993
2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
3. NAVFAC MO-312, Wood Protection, 1990
4. Architectural Graphic Standards, Seventh Edition, Ramsey/Sleeper, 1981
5. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994
6. Building Design and Construction Handbook, Frederick S. Merritt, 1982

02.08 RAMPS

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
1	GS-II 02.08.03-1
2	GS-II 02.08.05-2

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1	GS-III 02.08.01-1
2	GS-III 02.08.01-2
3	GS-III 02.08.02-3
4	GS-III 02.08.03-4

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: RAMPS - WOOD
CONTROL NUMBER: GS-II 02.08.03-1

Application

This guide applies to the investigation of deterioration of wood ramps due to insect infestation, rot, or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993

2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

3. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 2

COMPONENT: HANDRAILS/GUARDRAILS - WOOD
CONTROL NUMBER: GS-II 02.08.05-2

Application

This guide applies to the investigation of deterioration of wood handrails/guardrails due to insect infestation, rot, or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993
2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
3. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: RAMPS - CONCRETE
CONTROL NUMBER: GS-III 02.08.01-1

Application

This guide applies to the investigation of cracks and spalls in concrete structural frames, by a structural engineer/specialist.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage, and if further test are required at this time:
   a. Check general appearance for any conditions that may cause cracking, spalling or surface deterioration.
   b. Examine cracks or spalls to determine if they are active or dormant. Document the location, pattern, depth, width and length.
   c. Perform NDT, such as ultrasonic pulse velocity inspection of the defects to determine extent of subsurface damage.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: RAMPS - CONCRETE
CONTROL NUMBER: GS-III 02.08.01-2

Application

This guide applies to the investigation of corrosion or reinforcing steel in concrete structural frames, by a structural engineer/specialist.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage, and if further test are required at this time:
   a. Check for exposure and environmental conditions, specifically chemical attack.
   b. Check for adequacy of concrete cover to protect it from corrosion.
   c. Perform NDT to determine corrosion activity, such as a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: RAMPS - METAL
CONTROL NUMBER: GS-III 02.08.02-3

Application

This guide applies to the investigation of cracks and cracked welds in steel structural frames, by a structural engineer/specialist.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage and if further test are required at this time:
   a. Clean area (wire brush) to bare metal.
   b. Apply dye, allow to penetrate, remove excess.
   c. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
   d. Perform NDT, such as high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
   e. Check any other suspect areas such as patches and repairs.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4

COMPONENT: RAMPS - WOOD
CONTROL NUMBER: GS-III 02.08.03-4

Application

This guide applies to the investigation of deterioration of wood structural frames due to insect infestation, rot or fungi damage, by a structural engineer/specialist of deterioration.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage and if further test are required at this time:
   a. Sound with hammer.
   b. Bore or core (should be angled to prevent water accumulation). Plug hole with treated dowels. Examine core at the site and send to laboratory for biological studies.
   c. Test with a moisture meter.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Increment borer
2. Moisture meter
3. Treated wood dowels
4. One-pound hammer

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993
2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
3. NAVFAC MO-312, Wood Protection, 1990

02.09 STACK STRUCTURES

DESCRIPTION

Stack Structures is a subsystem of the Building Superstructure System. A stack is a vertical hollow shaft for conveying flue gases and products of combustion to the outside atmosphere. The stack may be constructed of reinforced concrete, brick or concrete block masonry, or prefabricated metal. Stacks typically have a cap made of concrete or metal, to reduce down-drafting, and a metal access door. Depending on the height of the stack, it may also have a guying system to provide additional support. Concrete and masonry stacks may be provided with a metal ladder. Stacks are used for industrial as well as domestic applications.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

The following list of special tools and equipment, beyond the requirements listed in the Standard Tool Section, are required to perform the inspection of Stacks:

1. Binoculars
2. Wire brush
3. Dye, paintbrush, developer and rags

SPECIAL SAFETY REQUIREMENTS

The following special safety requirements, beyond those listed in the Master Safety Plan and System Safety Section, are necessary to perform the inspection of Stacks.

1. Inspectors should be aware of the possibility of hot surfaces.
2. Safety belts are required while performing ladder inspections.
3. Ladder rungs should be checked to see if they can support the inspector's weight.

COMPONENT LIST

- 02.09.01 STACK STRUCTURES - CONCRETE
- 02.09.02 STACK STRUCTURES - MASONRY
- 02.09.03 STACK STRUCTURES - METAL
- 02.09.04 LADDERS - METAL
- 02.09.05 ACCESS DOORS - METAL
- 02.09.06 STACK CAPS - CONCRETE
- 02.09.07 STACK CAPS - METAL
- 02.09.08 GUYING SYSTEMS
- 02.09.09 STACK STRUCTURES FINISH

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following should be reviewed for concurrent inspection activities.

01.02	SLABS-ON-GRADE, BASES AND PITS
04	BUILDING ROOFING

02.09 STACK STRUCTURES

STANDARD INSPECTION PROCEDURE

This subsystem requires both Level I and Level II inspections as the basic inspection process. Additional Level II inspections may be indicated or "triggered" by the Level I inspection observations and should be accomplished by the inspector at that time. Associated defects and observation, for each major component, are listed in the inspectors' Data Collection Devices.

COMPONENTS

◆ 02.09.01 STACK STRUCTURES - CONCRETE

A concrete stack structure is constructed of reinforced concrete, with an approved flue liner. Surface temperature should be checked in the area of structural cracks and spalling for indication of flue liner condition. Scaling is usually a finish or curing defect while spalling is a stress defect. Cracking may be the result of either of the above.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Cracking.**			
Observation:			
a. Open cracks, up to 1/16" in width. *** {Severity M}	LF		
b. Open cracks, greater than 1/16" in width or exceeding 2" in depth. *** {Severity H}	LF		1
c. Extensive disintegration of surface or cracks exceeding depth of 2". *** {Severity H}	SF		1
*** Reinforcing steel corrosion.**			
Observation:			
a. Rusting/discoloration evident, cracks occurring parallel to reinforcement. *** {Severity H}	SF		2
b. Exposure of reinforcing steel. *** {Severity H}	SF		2

02.09 STACK STRUCTURES

COMPONENTS (Continued)

◆ 02.09.01 STACK STRUCTURES - CONCRETE (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Scaling and spalling.**			
Observation:			
a. Scaling of surface up to 1/4" deep, with exposure to coarse aggregates.	SF		
*** {Severity L}			
b. Scaling of surface from 1/4" to 1/2" deep with coarse aggregates clearly exposed.	SF		
c. Spalling more than 1" deep, in beam or column - not at joint or juncture.	SF		1
*** {Severity M}			
d. Scaling of surface exceeding 1/2" deep.	SF		
*** {Severity H}			
e. Spalling more than 1" in depth in beam or column - at a joint or juncture.	SF		1
*** {Severity H}			

02.09 STACK STRUCTURES

COMPONENTS (Continued)

◆ 02.09.02 STACK STRUCTURES - MASONRY

Masonry stacks are usually built of brick or concrete blocks enclosing a flue liner. Surface temperature should be checked in the area of deteriorated bricks, CMU and mortar for indication of flue liner condition.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged bricks or CMU.**			
Observation:			
a. Cracked, split, damaged.	SF		3
*** {Severity M}			
b. Loose, missing.	SF		3
*** {Severity H}			
*** Defective mortar.**			
Observation:			
a. Evidence of efflorescence.	SF		
*** {Severity L}			
b. Cracked joint material.	SF		
*** {Severity L}			
c. Separated/missing joint material.	SF		
*** {Severity H}			

02.09 STACK STRUCTURES

COMPONENTS (Continued)

◆ 02.09.03 STACK STRUCTURES - METAL

Metal stack systems are usually pre-fabricated (factory built). They are commonly double- or triple-wall insulated. When operating, a wall too hot to touch indicates possible liner or insulation problems. Steel wall glow gives indication of temperatures; i.e., dark red indicates temperature of 1100-1500 degrees F.; bright red indicates temperature of 1500-1800 degrees F. The associated breeching shall also be inspected.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Missing or damaged liner/insulation.**			
Observation:			
a. Overheating, too hot to touch.	EA	1	
*** {Severity M}			
b. Overheating, dark red color.	EA	1	
*** {Severity M}			
c. Overheating, loss of base metal, bright (cherry) red.	EA	1	4
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
b. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			
*** Damaged breeching.**			
Observation:			
a. Bent breeching.	LF		
*** {Severity M}			
*** Defective breeching connectors.**			
Observation:			
a. Press fit coming apart.	EA		
*** {Severity L}			
b. Damaged or loose fasteners.	EA		
*** {Severity M}			
c. Missing fasteners.	EA		
*** {Severity H}			
d. Deformed connectors.	EA		
*** {Severity H}			

02.09 STACK STRUCTURES

COMPONENTS (Continued)

◆ 02.09.04 LADDERS - METAL

Concrete and masonry stacks, depending on their height, are sometimes provided with metal ladders fastened to the side of the stack. Typically, a standard metal ladder would have 3/4" diameter rungs, spaced 12" on-center, plug welded into 3/8" X 2 1/2" (minimum) side rails. The ladder is usually anchored into the stack with brackets providing 7" clearance. In some cases, 3/4" diameter rungs are simply set into the concrete or masonry, spaced 12" on-center.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Defective connections/anchorage.**			
Observation:			
a. Loose/missing bolts, rivets, or mechanical fasteners.	EA		
*** {Severity H}			
b. Cracked or broken welds.	EA	2	
*** {Severity H}			
*** Cracking or buckling of frame.**			
Observation:			
a. Deformation, twisting, or bending.	LF		
*** {Severity H}			
b. Physically damaged member.	LF		
*** {Severity H}			
c. Stress or fatigue cracks.	LF	2	
*** {Severity H}			
d. Missing rungs.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Corrosion evidenced by pitting or blistering.	LF		
*** {Severity M}			
b. Corrosion evidenced by holes or loss of base metal.	LF		
*** {Severity H}			

02.09 STACK STRUCTURES

COMPONENTS (Continued)

◆ 02.09.05 ACCESS DOORS - METAL

Metal access doors are normally provided on stacks to facilitate cleaning. They are usually provided at the base of the stack.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged door or hardware.**			
Observation:			
a. Distorted, twisted, loose.	EA		
*** {Severity L}			
b. Damaged or missing door liner.	EA		
*** {Severity M}			
*** Corrosion.**			
Observation:			
a. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
b. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			

02.09 STACK STRUCTURES

COMPONENTS (Continued)

◆ 02.09.06 STACK CAPS - CONCRETE

Low, open (uncapped) stacks may not perform well in windy conditions. A chimney cap helps alleviate the back-pressure effect of the wind. Many designs are used, but a flat plate on posts is a common and simple cap for concrete and masonry chimneys.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Restricted flow.**			
Observation:			
a. Debris or other obstruction.	EA		
*** {Severity M}			
b. Loose or damaged stack cap.	EA		
*** {Severity H}			
*** Surface deterioration.**			
Observation:			
a. Cracks greater than 1/4" wide.	LF		
*** {Severity H}			
b. Spalling/scaling more than 1" depth greater than 6" DIA.	SF		
*** {Severity H}			

02.09 STACK STRUCTURES

COMPONENTS (Continued)

◆ 02.09.07 STACK CAPS - METAL

Many kinds of metal caps are used to restrict down-drafting especially on metal chimneys.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Restricted flow.**			
Observation:			
a. Debris or other obstruction.	EA		
*** {Severity M}			
b. Loose or damaged stack cap.	EA		
*** {Severity H}			
*** Surface deterioration.**			
Observation:			
a. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
b. Corrosion evidenced by holes or loss of base metal.	SF		
*** {Severity H}			

02.09 STACK STRUCTURES

COMPONENTS (Continued)

◆ 02.09.08 GUYING SYSTEMS

Depending on the height, design and code, external support may have to be provided by a guying system. Guy bands girdle the structure and are connected to anchors by wire rope cables. Guys must be kept tight and in good condition.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged cables.**			
Observation:			
a. Loose cables.	EA		
*** {Severity M}			
b. Worn cables (frayed surface).	EA		
*** {Severity H}			
c. Cracked or broken cables.	EA		
*** {Severity H}			
*** Damaged connectors/anchors.**			
Observation:			
a. Loose connectors.	EA		
*** {Severity M}			
b. Cracked or broken connectors.	EA		
*** {Severity H}			
*** Corrosion.**			
Observation:			
a. Surface corrosion no pitting evident.	EA		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

02.09 STACK STRUCTURES

COMPONENTS (Continued)

◆ 02.09.09 STACK STRUCTURES FINISH

Finishes are applied as a thin layer of coating to a substrate by brush, roller, sprayer or other suitable methods. The coating seals, protects or provides the desired appearance.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Finish Damage.**			
Observation:			
a. Finish damage evidenced by mars, scratches, scuffs, fading and discoloration.	SF		
*** {Severity L}			
b. Finish material damage, no exposure of substrate.	SF		
*** {Severity M}			
c. Finish material damage evidenced by exposure of substrate.	SF		
*** {Severity H}			

02.09 STACK STRUCTURES

REFERENCES

1. Uniform Building Code, 1988 Edition
2. NAVFAC MO-322, Vol. 2, Inspection of Shore Facilities, 1993
3. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
4. Solid Fuels Encyclopedia, Jan W. Shelton, 1983
5. Physical Plant Operations Handbook, K.L. Petrocelly RPA, C.P.E., 1988

02.09 STACK STRUCTURES

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
1	GS-II 02.09.03-1
2	GS-II 02.09.04-2

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1	GS-III 02.09.01-1
2	GS-III 02.09.01-2
3	GS-III 02.09.02-3
4	GS-III 02.09.03-4

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: STACK STRUCTURE - METAL
CONTROL NUMBER: GS-II 02.09.03-1

Application

This guide applies to the investigation of excessive surface temperature of a metal stack, indicating possibility of deteriorated or missing flue liner or insulation.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Visually observe the color of the steel stack, using the color scale of temperature.

COLOR SCALE OF TEMPERATURE

Color	Temperature (Degrees F)
Incipient red heat	900-1100
Dark red heat	1100-1500
Bright red heat	1500-1800
Yellowish red heat	1800-2200
Incipient white heat	2200-2600
White heat	2600-2900

2. If overheating (over 1500 degrees F, per scale), liner or insulation may be missing or damaged.

Recommended Inspection Frequency

Perform inspection when triggered by Level I inspection or other local factors such as problematic conditions.

References

1. Architectural Graphic Standards, Seventh Edition, Ramsey/Sleeper, 1981

2. Physical Plant Operations Handbook, K.L. Petrocelly RPA, C.P.E., 1988

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 2

COMPONENT: LADDERS - METAL
CONTROL NUMBER: GS-II 02.09.04-2

Application

This guide applies to the investigation of cracks or cracked welds in metal ladders.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.

Recommended Inspection Frequency

Perform inspection when triggered by Level I inspection or other local factors such as problematic conditions.

References

1. Architectural Graphic Standards, Seventh Edition, Ramsey/Sleeper, 1981

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: STACK STRUCTURES - CONCRETE
CONTROL NUMBER: GS-III 02.09.01-1

Application

This guide applies to the investigation of cracks and spalling in concrete stacks, by a structural engineer/specialist.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect defect to determine the extent and severity of damage and if further test are required at this time:
   a. Check general appearance for any conditions that may cause cracking or surface deterioration.
   b. Check cracks for any stress related condition, construction movement or settlement.
   c. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment
2. Appropriate lift 60' high

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: STACK STRUCTURES - CONCRETE
CONTROL NUMBER: GS-III 02.09.01-2

Application

This guide applies to the investigation of and corrosion of reinforcing steel in concrete stack structures, by a structural engineer/specialist.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage and if further test are required at this time:
   a. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
   b. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
   c. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment
2. Appropriate lift 60' high

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: STACK STRUCTURES - MASONRY
CONTROL NUMBER: GS-III 02.09.02-3

Application

This guide applies to the investigation of cracks in a masonry stack structures, by a structural engineer/specialist.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Inspect the defect to determine the extent and severity of damage and if further test are required at this time:
   a. Check general appearance for any condition that may cause cracking or surface deterioration.
   b. Check cracks for any stress related condition, construction movement or settlement.
   c. Perform NDT to determine extent of internal cracking and damage, in this case low frequency ultrasonic pulse velocity inspection.
2. Document findings and forward to appropriate authority.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity test equipment
2. Appropriate lift 60' high

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4

COMPONENT: STACK STRUCTURES - METAL
CONTROL NUMBER: GS-III 02.09.03-4

Application

This guide applies to the investigation of excessive surface temperature of a metal stack, indicating possibility of deteriorated or missing flue liner or insulation.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Shut down operation and allow stack to cool. This could take days, depending on size and operating temperatures.
2. Investigate interior of stack for deterioration or missing flue liner.
3. Document findings and forward to appropriate authority.

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Architectural Graphic Standards, Seventh Edition, Ramsey/Sleeper, 1981

2. Physical Plant Operations Handbook, K.L. Petrocelly RPA, C.P.E., 1988

APPENDIX A

ABBREVIATIONS

AIC	American Institute Of Chemists
CAIS	Condition Assessment Information System
CAS	Condition Assessment Survey
CERL	Construction Engineering Research Laboratory
CMU	Concrete Masonry Unit
DCD	Data Collection Device
DIA	Diameter
EA	Each
FT	Feet
GS	Guide Sheet
HR	Hour
IU	Inspection Unit
LF	Linear Foot
N/A	Not Applicable
NAVFAC-MO	Naval Facilities Maintenance and Operations
NDT	Non-Destructive Testing
PE	Professional Engineer
PM	Preventive Maintenance
RPIL	Real Property Inventory List
SF	Square Foot
TM	Technical Manual
UOM	Unit Of Measurement

APPENDIX A

YRS	Years
WBS	Work Breakdown Structure
°	Degrees of Temperature
°C	Degrees Centigrade
°F	Degrees Fahrenheit
=	Equals
'	Feet
>	Greater Than
≥	Greater Than or Equal To
"	Inches
<	Less Than
≤	Less Than or Equal To
/	Per or Over
%	Percent
+	Plus or Positive or Add
±	Plus or Minus
–	Subtract or Minus or Negative
·	Times or By
x	Times or By

APPENDIX B

GLOSSARY

Adobe	Large, roughly molded, sun-dried clay brick of varying sizes.
Aggregate	An inert granular material such as natural sand and gravel which when bound together into a mass by a matrix forms concrete or mortar.
Anchorage	Devices used to attach the structural members to the building frame.
Balustrade	An entire railing system (as along the edge of a balcony) including a top rail and its balusters (one of a number of short vertical members ... used to support a stair handrail or a coping).
Base Metal	The metal to be welded, soldered, or plated.
Beam	A structural member whose prime function is to carry transverse loads, as a joist, girder, rafter, or purlin.
Bracing	Structural elements installed to provide restraint or support (or both) to other members, so that the complete assembly forms a stable structure; may consist of knee braces, cables, rods, struts, ties, shores, diaphragms, and rigid frames.
Breeching	The duct or pipe connecting the exhaust-gas discharge from a boiler, furnace, or other fuel-burning equipment, to a stack.
Cantilever	A beam, girder, truss, or other structural member which projects beyond its supporting wall or column.
Column	In structures, a relatively long, slender structural compression member such as a post, pillar, or strut; usually vertical, supporting a load which acts in (or near) the direction of its longitudinal axis.
Corrosion	The deterioration of metal or of concrete by chemical or electrochemical reaction resulting from exposure to weathering, moisture, or chemicals, or other agents in the environment.
Decay	A deterioration or decomposing as of vegetable matter.

APPENDIX B

Decking	The thick boards or planks used as structural flooring, usually for long spans between joists or for heavy service; or light-gauge sheets of metal which are ribbed, fluted, or otherwise integrally stiffened for use in constructing a floor or roof.
Dielectric	A nonconductor of electricity; an insulator or insulating material.
Down Draft	A downward current of air in a chimney or flue, often carrying smoke with it.
Flue	An incombustible and heat-resistant enclosed passage in a chimney or stack, to control and carry away products of combustion from a fireplace, furnace, or boiler to the outside air.
Fluted Deck	A plastic or metal panel that has been manufactured with fluting (parallel grooves or channels) usually semicircular or semi-elliptical in section; used to provide structural strength to the panel.
Fungus	Any of a large group, including molds, mildews, mushrooms, rusts, and smuts, which are parasites on living organisms or feed upon dead organic material, lack chlorophyll, true roots, stems,leaves, and reproduce by means of spores.
Girder	A large or principle beam of steel, reinforced concrete, or wood; used to support concentrated loads at isolated points along its length.
Guys	A supporting rope, cable, or wire which is anchored at one end and tied to a vertical object or structure in order to stabilize it.
Half-cell Test Equipment	In electrochemical cells, the electrical potential developed by the overall cell reaction can be considered, for calculation purposes, as the sum of the potential developed at the anode and the potential developed at the cathode, each being a half-cell. This difference in potential can be detected by placing a copper/ copper sulfate half-cell on the surface of the concrete and measuring the potential differences between the reinforcing steel and a wet sponge on the concrete surface. The reference cell connects the concrete surface to a high-impedance voltmeter, which is also connected electrically to the reinforcing steel mat.

APPENDIX B

Incipient Decay	Early stages of decay in wood in which the color has changed but the strength and hardness have not yet been affected.
Joists	One of a series of parallel beams of timber, reinforced concrete, or steel used to support floor and ceiling loads, and supported in turn by larger beams, girders, or bearing walls; the widest dimension is vertically oriented.
Landings	The horizontal platform at the end of a stair flight or between two flights of stairs.
Lashings	The use of rope or wire to bind several members together by the use of knots and repetitive wrapping.
Level	A horizontal line or plane; especially such a plane taken as a basis for the measure of elevation.
Life Cycle	Under normal conditions, the expected life span based on proper installation and preventive maintenance.
Monolithic	Reinforced concrete, cast with no joints other than construction joints.
Nosing	The prominent, usually rounded, horizontal edge which extends beyond an upright face below; as the projection of a tread beyond a riser.
Open Web Joists	A steel truss having an open web (composed of a group of members in a crisscross or zigzag array instead of solid plates) whose component parts are either hot-rolled structural shapes or cold-formed light-gauge steel shapes.
Parasite	A plant or animal that lives on or in an organism of another species from which it derives sustenance or protection without benefitting the host and usually doing harm.
Plumb	Exactly vertical.
Pop-outs	A conical fragment that has broken out of the surface of the concrete leaving small holes. Generally a shattered aggregate particle will be found at the bottom of the hole, with a part of the fragment still adhering to the small end of the pop-out cone. Pop-outs are caused by reactive aggregates and high alkali cement. They are also caused by aggregates such as shale, which expand with moisture.

APPENDIX B

Rafters	One of a series of inclined members to which a roof covering is affixed.
Refractory	A material, usually nonmetallic used to withstand high temperatures.
Resistance Meter	A meter that measures the physical property of a device, conductor, element, branch, or system, by virtue of which power is lost as heat when current flows through it; or the physical property which an electric conductor exhibits to the flow of current; measured in ohms.
Ribbed Deck	See fluted deck.
Rot	Decomposition in wood by fungi and other microorganisms; reduces the strength, density, and hardness.
Rungs	A bar, usually round in cross-section, forming the step of a ladder.
Scaling	The gradual and continuing loss of surface mortar and aggregate over an area; due to the failure of the cement paste caused by chemical attack or freeze/thaw cycles.
Sheet Metal Gauge	Used to measure a flat, rolled metal product, rectangular in cross section and form, of thickness between 0.006 and 0.249in. with sheared, sawn or slit edges.
Slab	Either the level part of a reinforced concrete floor, which is carried on beams below. Or a concrete mat poured on subgrade, serving as a floor rather than as a structural member.
Spalling	A roughly circular or oval depression in the concrete. Spalls result from the separation and removal of a portion of the surface concrete, revealing a fracture roughly parallel to the surface. Spalls can be caused by corroding reinforcement steel and friction from thermal movement; reinforcing steel is often exposed.
Spandrel	In a multi-story building a wall panel filling the space between the top of the window of one story and the sill of the window in the story above. Or a surface, roughly triangular in shape, as below a stair string.

APPENDIX B

Test	An examination, experiment or trial as to prove the value, or ascertain the nature of something. Or a standard or criterion by which the qualities of a thing are tried.
Tread	The horizontal portion of a step including the nosing.
Truss	A structural unit composed of a combination of members, usually in some triangular arrangement so as to constitute a rigid framework.
Ultrasonic Pulse Velocity Test	An ultrasonic detector is used either in scanning (non-contact) or in contact mode. The pulse velocity test uses the contact mode. A metal probe (transducer) supplied with the detector is stimulated by ultrasound and transmits the waves, when touched against equipment surfaces, to another detector. The velocity of this ultrasonic pulse is measured; the faster the pulse the more dense the material tested. The test can also detect and evaluate cracks, voids, delamination and other defects.

APPENDIX C

LIFE CYCLES

02 SUPERSTRUCTURE

02.01 STRUCTURAL FRAMES

Concrete	45 YRS
Steel	45 YRS
Wood	35 YRS

Source:
Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

02.02 FLOOR FRAMING AND DECKS

Concrete	45 YRS
Steel	45 YRS
Wood	25 YRS

Source:
Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

02.03 ROOF FRAMING AND DECKS

Concrete	45 YRS
Steel	45 YRS
Wood	25 YRS

Source:
Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

02.04 BALCONIES

Concrete	35 YRS
Metal	30 YRS
Wood	15 YRS

Source:
Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

APPENDIX C

02.05 CANOPIES

Concrete	40 YRS
Metal	20 YRS
Wood	20 YRS

Source:
Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

02.06 STAIRS

Concrete	15 YRS
Metal	20 YRS
Wood	25 YRS

Source:
Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

02.07 LADDERS

Ladders - metal	20 YRS
Ladders - wood	20 YRS

Source:
Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

02.08 RAMPS

Concrete	35 YRS
Metal	30 YRS
Wood	15 YRS

Source:
Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

02.09 STACKS

Concrete	35 YRS
Masonry	35 YRS
Metal	25 YRS

Source:
Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988